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Index

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SOIL CONSERVATION—INDEX TO VOLUME VII

JULY 1941 TO JUNE 1942

	Page		Page
Acre, selective service for each. Glennon Loyd	209-210	Bobwhite, benefits from soil conservation	251-252
ADKINS, HOMER M., Governor of Arkansas, pro- clamation	81	BOND, R. M.: Deerweed	264
Agricultural conservation. Extract from Phila- delphia Society for Promoting Agriculture in the year 1814. See Back cover April issue.		Wildlife Increased by Erosion Control Prac- tices. With A. C. Hawbecker	255-256
Agriculture— defense activities, clearinghouse for. M. Clifford Townsend	97-99, 111	BORELL, A. E.: Water for Wildlife in the South- west	258, 262
movement, onward, statistics of soil conserva- tion district organization. J. Phil Camp- bell	182-196	BROOKS, MAURICE: Hill Culture for National Defense—And Afterward	270-272, 286
Alabama, conservation plan. J. N. Lowe	10-14	BROWN, GROVER F.: Grass Silage and Soil Con- servation	19-22
ALLAN, PHILIP F.: Barbed Wire Conserves Soil and Wildlife. With Palmer R. Sime	263-264	BROWN, HUGH A.: Principles Affecting the Con- trol of Erosion in Road Cuts and Roadside Ditches. With J. W. Johnson	138-140
ANDERSON, WALLACE L.: Adolph Lee Looked Ahead	251	Bulldozers and grade A milk. A. T. Semple	215-218
ANGLE, William T.: War Production and the Technician	294, 303	BURKHALTER, HARVEY D.: Providing for Wild- life in Farm Planning. With Homer G. Towns	254
Argentina, pampas of, wind erosion in. Man- fredo A. L. Reichart	298-300	BURNS, FRED C.: District and Schools Cooper- ate in Handling Equipment	179-180
Assessors, statement on cost of erosion control	85	CAMPBELL, J. PHIL: An Agricultural Movement Marches On. Statistical Story of the Soil Conservation District Organization	182-196
AUSTIN, STANLEY W.: A Story of Pond Protec- tion	262	CARNES, ERNEST: Big-Scale Demonstration of Putting Soil Conservation on the Land	279-281
BAILEY, R. Y.: Check-Up on Perennial Forage Plants	142-145	CARR, HARRY L.: Tooling Up for Soil Conser- vation. With G. E. Ryerson	113-116, 126
Bankers— approval of soil conservation practices, testi- monials	124-126	CARROLL, HARRY B.: This County Supports Its District. With Frank B. Harper	54-57
cash valuation on conservation program. A. E. McClymonds	65-66	CARTER, L. S.: Tillage and Crop Residue Man- agement	155-158, 173
Banks, spoil, planting. R. E. Culbertson and Richard M. May	260	Cartographic Division and National Defense. Harry T. Kelsh	44-45, 58
BEAMON, W. F.: Photographic Method of Pre- paring Farmer-District Agreement Maps. With M. S. Kennedy	146-147, 149	CAULEY, T. J.: Conservation Planning for Small Farms	26-27, 28
Beaver on trial. Paul M. Scheffer	239-241	Central Great Plains, rains on. L. L. Harrold	85
BENNETT, H. H.: Conservation Along the Oregon Trail	129-134, 137	CHARLES, F. E.: Conservation Against a Horizon of War	31-33
Conservation Comes to the Golden Gate	197-206	Indiana District Plans Farms by Watersheds	18, 28
Humptulips and White Salmon	159-168	Michigan District Grows Millions of Trees	227
Land and People	71-76, 81	Wanted: Technical Assistance Only	66-69, 79, 86
"Look At America"—A Great Democracy Does Things!	29-30, 36	Chesapeake Bay shore, erosion on. John Cot- ton	277-279
Total Conservation	233-235	Civilian Conservation Corps, progress. G. H. Gilbertson	212-214, 222
Birds and conservation. J. K. Terres and E. C. Murdoch	303	Civilian defense, mobilization of Conservation Service equipment for. G. E. Ryerson	211-212
Bluffs, clay, of Lake Michigan, erosion control. B. A. Myers	206-208	Clay bluffs, of Lake Michigan, erosion control. B. A. Myers	206-208

	Page
Common sense, triumph.....	42-43
COMPTON, LAWRENCE V.: Food From Ponds.....	236-237
Conservation—	
K. F. Warner.....	152
against a horizon of war. F. E. Charles.....	31-33
along Oregon Trail. H. H. Bennett.....	129-134, 137
and birds. J. K. Terres and E. C. Murdock.....	303
farming and yields, facts concerning. R. E. Uhland. See Back cover May issue.....	266-269, 276
farming on a cotton and tobacco farm. W. C. Eagles.....	16-17
goes on the air. F. A. Rankin.....	135-137
in Golden Gate region. H. H. Bennett.....	197-206
plan in Alabama. J. N. Lowe.....	10-14
planning for small farms. T. J. Cauley.....	26-27, 28
practices, approval by bankers, testimonials.....	124-126
program, cash valuation by bankers. A. E. McClymonds.....	65-66
total. H. H. Bennett.....	233-235
See also Soil conservation and under specific kinds.	
Cooperation in fire fighting. A. E. McClymonds.....	174, 175
Corn, Indian, perplexing case concerning. William R. Van Dersal.....	46-51
COTTON, JOHN: Shore Erosion on the Chesapeake.....	277-279
Cotton farm, conservation farming on. W. C. Eagles.....	16-17
County support of soil conservation district. Harry B. Carroll and Frank B. Harper.....	54-57
CRAIG, D. G.: The Valimont Farm.....	107-109
Crop—	
husbandry during this war. C. R. Enlow.....	289-291, 300
new, for old farm. William C. Pryor.....	89-93
residue and tillage management. L. S. Carter.....	155-158, 173
CULBERTSON, R. E.: Planting Spoil Banks and Ditches. With Richard M. May.....	260
CUTTER, L. S.: Farm Machinery and Farming Methods in Soil Conservation. With R. A. Norton.....	100-106
DAMBACH, CHARLES A.: Fence Row Facts.....	238
Ten Years of Protection.....	252-253, 254, 256
DAVIDSON, JOE B.: Osage-Orange Plantings. With Charles F. McGraw.....	303
DAVIS, ARNOLD, statement concerning plow as link in agriculture. See Back cover November issue.	
DAVISON, VERNE E.: Does Kudzu Have Wildlife Value?.....	253
Shrubs by Direct Seeding.....	242-243
Soil Conservation Favors Bobwhite.....	251-252
Deerweed. R. M. Bond.....	264
Defense—	
activities, agriculture's clearinghouse for. M. Clifford Townsend.....	97-99, 111

Defense—Continued.	
for soil building with sod. C. R. Enlow.....	52-54
growing legumes for.....	86
needs, land for. James M. Gray.....	34-36
rehearsal for. G. H. Gilbertson.....	37-39, 43
Democracy, accomplishments, example of America. Hugh Hammond Bennett.....	29-30, 36
Ditches—	
and spoil banks, planting. R. E. Culbertson and Richard M. May.....	260
roadside, erosion control in, principles affecting. J. W. Johnson and Hugh A. Brown.....	138-140
Drainage—	
and food for freedom program. James Turnbull.....	265-266
improvement by plowing fields in beds.....	227
EAGLES, W. C.: Conservation Farming on a Cotton and Tobacco Farm.....	16-17
EDMINSTER, FRANK C.: More Ruffed Grouse From Woodland Management.....	261, 262
ENLOW, C. R.: Building a Sod Defense.....	52-54
Crop Husbandry in This Year of War.....	289-291, 300
Equipment—	
Conservation Service, mobilization for civilian defense. G. E. Ryerson.....	211-212
handling, with cooperation of district and schools. Fred C. Burns.....	179-180
Erosion—	
control—	
for reservoir protection. Harry E. Reddick.....	77-79
in road cuts and roadside ditches, principles affecting. J. W. Johnson and Hugh A. Brown.....	138-140
on Lake Michigan's clay bluffs. B. A. Myers.....	206-208
practices, effect on wildlife increase. A. C. Hawbecker and R. M. Bond.....	255-256
double check on. M. E. Mortimore.....	150-151
minimum, growing soybeans with. Dwight D. Smith.....	295-296, 300
shore, on Chesapeake Bay. John Cotton.....	277-279
wind, in the pampas of Argentina. Manfred A. L. Reichart.....	298-300
FARIS, PHOEBE O'NEALL: Book Reviews and Abstracts. Each issue except February, March, April.	
Farm—	
conservation, planning for war needs. E. H. Reed. See Back cover March issue.....	224-226, 232
consideration with farmer. E. H. Reed.....	153-154, 173
cotton and tobacco, conservation farming on. W. C. Eagles.....	16-17
land, conservation for reduction of highway maintenance costs. George C. Moore. See Back cover, January issue.....	166

	Page
Farm—Continued.	
machinery and farming methods, use in soil conservation. L. S. Cutter and R. A. Norton.....	100-106
old, new crop for. William C. Pryor.....	89-93
planning, provisions for wildlife. Homer G. Towns and Harvey D. Burkhalter.....	254
Farm Security Administration, clients, aptitude for soil conservation planning.....	14
Farmer—	
consideration with farm. E. H. Reed.....	153-154, 173
district agreement maps, preparation by photographic method. W. F. Beamon and M. S. Kennedy.....	146-149
plans and work. L. A. Wilkins.....	15
Farmers—	
cooperaton with Soil Conservation Service in rehabilitation work.....	14
seasonal soil and water conservation practices, installation without technical assistance. H. P. Moffitt.....	178
Farming—	
conservation, and yields, facts concerning. R. E. Uhland. <i>See</i> Back cover May issue.....	266-269, 276
conservation, on a cotton and tobacco farm. W. C. Eagles.....	16-17
methods and farm machinery, use in soil conservation. L. S. Cutter and R. A. Norton.....	100-106
Farms—	
by watersheds in Indiana, plans for. F. E. Charles.....	18, 28
irrigated, wildlife management on. H. P. Pratt and W. S. Long.....	257-258
small, conservation planning. T. J. Cauley.....	26-27, 28
Fence row facts. Charles A. Dambach.....	238
Field, footprints in. William C. Pryor.....	80-81
Fields, plowing in beds for drainage.....	227
Fiero, Kenneth: Utilization of Range Plants on Wyoming Winter Sheep Ranges.....	281-284
Fire fighting, cooperation. A. E. McClymonds.....	174, 175
Fish, restocking streams in Dust Bowl area.....	243
Fishing, man's ancient occupation. W. R. Van Dersal. <i>See</i> Back cover October issue.	
Floods in the Navajo country. L. L. Harrold.....	172-173
Food—	
for freedom and drainage program. James Turnbull.....	265-266
for freedom with soil conservation. Lloyd E. Partain.....	177-178
from ponds. Lawrence V. Compton.....	236-237
Footprints in fields. William C. Pryor.....	80-81
Forage plants, perennial, check-up on. R. Y. Bailey.....	142-145
FORD, JOHN W., Jr.: Building a Soil Conservation Program Through Group Activities.....	110

	Page
FOX, ADRIAN C.: Windbreaks and Their Value to Wildlife.....	259-260
Furs, million dollar resource in Iowa. Sylvan T. Runkel.....	237
GILBERTSON, G. H.:	
Rehearsal for Defense.....	37-39, 43
The CCC Marches On.....	212-214, 222
Golden Gate region, conservation in. H. H. Bennett.....	197-206
GRAHAM, EDWARD H.:	
Grasses for Soil and Wildlife Conservation.....	244-247, 250
statement on value of blue grama grass in erosion control. <i>See</i> Back cover September issue.	
Grass—	
return to Callaway County, Missouri. Philip K. Hooker and Cleo H. Statton.....	273-276
silage and soil conservation. Grover F. Brown.....	19-22
Grasses—	
for soil and wildlife conservation. Edward H. Graham.....	244-247, 250
kinds used as wildlife food.....	244-247, 250
GRAY, JAMES M.: Land for Defense Needs.....	34-36
Group activities, use in building a soil conservation program. John W. Ford, Jr.....	110
Grouse, ruffed, increase from woodland management. Frank C. Edminster.....	261, 262
HARPER, FRANK B.:	
Snow Water. With Jack G. James.....	3-9
This County Supports Its District. With Harry B. Carroll.....	54-57
HARROLD, L. L.:	
Floods in the Navajo Country.....	172-173
Rains on the Plains.....	85
HASS, HOWARD C.: Sterile Streams Take on New Life.....	263
HAWBECKER, A. C.: Wildlife Increased by Erosion Control Practices. With R. M. Bond.....	255-256
Highway maintenance costs, reduction through farm land conservation. George C. Moore. <i>See</i> Back cover, January issue.....	166
Hill culture for national defense and afterward. Maurice Brooks.....	270-272, 286
HOOKE, PHILIP K.: King Grass Returns to the Kingdom of Callaway. With Cleo H. Statton.....	273-276
Horse power, raising by farmers. A. T. Semple.....	127
Human conservation in northern Wisconsin.....	284-286, 288
Humptulips and white salmon. H. H. Bennett.....	159-168
Hydrologic data and land use, graphic presentation. C. S. Jarvis and H. C. Murto.....	23-25
Indian corn. <i>See</i> Corn, Indian.	
Indiana, farms by watersheds, plans. F. E. Charles.....	18, 28

	Page
Iowa, furs, million dollar resource. Sylvan T. Runkel.....	237
JAMES, JACK G.: Snow Water. With Frank B. Harper.....	3-9
JARVIS, C. S.: Graphic Presentation of Land Use and Hydrologic Data. With H. C. Murto.....	23-25
JOHNSON, J. W.: Principles Affecting the Control of Erosion in Road Cuts and Roadside Ditches. With Hugh A. Brown.....	138-140
KELSH, HARRY T.: Cartographic Division and National Defense.....	44-45, 58
KENNEDY, M. S.: Photographic Method of Preparing Farmer-District Agreement Maps. With W. F. Beamon.....	146-147, 149
KIMBALL, FRANK: What of the Western Front? Kudzu—seedlings, growing in soil conservation nurseries.....	223-224 61-65
value as wildlife food. Verne E. Davison.....	253
wildlife value. Verne E. Davison.....	253
Lake Michigan, clay bluffs of, erosion control. B. A. Myers.....	206-208
LAMBERT, WILLIAM: This Stockman Believes in Soil Conservation Districts.....	230-232
Land—	
and people. H. H. Bennett.....	71-76, 81
for defense needs. James M. Gray.....	34-36
for more people in Mississippi Delta. John G. Sutton. See Back cover February issue.	203
man, opportunity and management—success. Charles G. Webb.....	94-96
soil conservation on, big-scale demonstration. Ernest Carnes.....	279-281
use and hydrologic data, graphic presentation. C. S. Jarvis and H. C. Murto.....	23-25
utilization, fitting to national defense. William R. Noble.....	40-41
Legumes for defense.....	86
LONG, W. S.: Wildlife Management on Irrigated Farms. With H. P. Pratt.....	257-258
"Look At America"—A Great Democracy Does Things! Hugh Hammond Bennett.....	29-30, 36
LOWDERMILK, W. C.: The Flag Is on the Plow.	292-293
LOWE, J. N.: The Alabama Conservation Plan.	10-14
LOYD, GLENNON:	
A Pasture That Does Not Take "Annual Leave".....	140-141, 145
Selective Service for Each Acre.....	209-210
Singing Plowboy Plows Crooked to Win....	169-171
LUSH, R. H.: Pasture Development in the South.....	117-120
Machinery, farm, and farming methods, use in soil conservation. L. S. Cutter and R. A. Nerton.....	100-106

	Page
Man, land, opportunity, and management—success. Charles G. Webb.....	94-96
Maps, farmer-district agreement, preparation by photographic method. W. F. Beamon and M. S. Kennedy.....	146-149
May, Richard M.: Planting Spoil Banks and Ditches. With R. E. Culbertson.....	260
McCLYMONDS, A. E.: Bankers Put Cash Value on Conservation Program.....	65-66
Cooperation in Fire Fighting.....	174, 175
Ups and Downs of a Wyoming Ranch.....	218-222
McDONALD, ANGUS: War and Soil Conservation.....	228-229
McGRAW, CHARLES F.: Osage-Orange Plantings. With Joe B. Davidson.....	303
McKEEVER, IVAN: Neighborhood Action.... Michigan—	301-302
conservation district, millions of trees growing on. F. E. Charles.....	227
Fenton Soil Conservation District, wildlife plans.....	96
Milk, grade A, and bulldozers. A. T. Semple.	215-218
Mississippi Delta, land for more people. John G. Sutton. See Back cover February issue.	203
Missouri, Callaway County, grass growing in, for soil conservation program.....	273-276
MITCHELL, H. C., statement on value of woodlands.....	175
MOFFITT, H. P.: Seasonal Soil and Water Conservation Practices Which Can Be Installed by Farmers Without Technical Assistance.....	178
Money value of woodland.....	175
Montana, farmer, Chris Olsen. William C. Pryor.....	121-123, 126
MOORE, GEORGE C.: Reducing Highway Maintenance Costs Through Farm Land Conservation. See Back cover, January issue.....	166
MORTIMORE, M. E.: A Double Check On Erosion.....	150-151
MURDOCH, E. C.: Birds and Conservation. With J. K. Terres.....	303
MURTO, H. C.: Graphic Presentation of Land Use and Hydrologic Data. With C. S. Jarvis.	23-25
MYERS, B. A.: Erosion Control on Lake Michigan's Clay Bluffs.....	206-208
National defense—	
fitting land utilization to. William R. Noble.	40-41
hill culture for, and afterward. Maurice Brooks.....	270-272, 286
National Defense and Cartographic Division.	
Harry T. Kelsh.....	44-45, 58
Navajo country, floods in. L. L. Harrold....	172-173
Neighborhoods, cooperation for conservation plans. Ivan McKeever.....	301-302
Neighborliness and terraces within a day. Arthur W. Susott.....	82-84
New Mexico, floods in, causes.....	172-173

	Page
NOBLE, WILLIAM R.: Fitting Land Utilization to National Defense.....	40-41
NORTON, R. A.: Farm Machinery and Farming Methods in Soil Conservation. With L. S. Cutter.....	100-106
OLSEN, CHRIS, Montana farmer. William C. Pryor.....	121-123, 126
OLSON, LOIS: The Oregon Trail. See Back cover December issue.	
Oregon Trail—	
Lois Olson. See Back cover December issue.	
conservation along. H. H. Bennett....	129-134, 137
Osage-orange plantings. Charles F. McGraw and Joe B. Davidson.....	303
PARTAIN, LLOYD E.: Food for Freedom With Soil Conservation.....	177-178
Pasture—	
development in the South. R. H. Lush....	117-120
mixtures, for meeting varying conditions, suggestions.....	87, 111, 175
production, continuous. Glennon Loyd....	140-141, 145
People—	
and land. H. H. Bennett.....	71-76, 81
land for in Mississippi Delta. John G. Sutton.	
See Back cover February issue.....	203
Photographs, use in preparing farmer-district agreement maps. W. F. Beamon and M. S. Kennedy.....	146-149
Plants, range, utilization on Wyoming winter sheep ranges. Kenneth Fiero.....	281-284
Plow—	
importance in wartime. W. C. Lowdermilk..	292-293
link in agriculture, statement by Arnold Davis. See Back cover November issue.	
Plowboy, singing, plowing crooked, advantages. Glennon Loyd.....	168-171
Plowing, crooked, by singing plowboy, advantages. Glennon Loyd.....	168-171
Pond protection, a story. Stanley W. Austin..	262
Ponds, food from. Lawrence V. Compton....	236-237
PRATT, H. P.: Wildlife Management on Irrigated Farms. With W. S. Long.....	257-258
PRYOR, WILLIAM C.:—	
A New Crop for the Old Farm.....	89-93
Chris Olsen, Montana Farmer.....	121-123, 126
Footprints in His Field.....	80-81
Puerto Rico, Soil Conservation Service programs.....	58
Radio, conservation programs. F. A. Rankin..	135-137
Rains on the Plains. L. L. Harrold.....	85
Ranch in Wyoming, failure and success. A. E. McClymonds.....	218-222
Range plants, utilization on Wyoming winter sheep ranges. Kenneth Fiero.....	281-284
RANKIN, F. A.: Conservation Goes on the Air..	135-137
REDDICK, HARRY E.: Erosion Control for Reservoir Protection.....	77-79

	Page
REED, E. H.:—	
Consider the Farmer as Well as the Farm..	153-154, 173
Farm Conservation Planning for War Needs.	
See Back cover March issue.....	224-226, 232
Reservoir protection by erosion control. Harry E. Reddick.....	77-79
Road cuts, erosion control in, principles affecting. J. W. Johnson and Hugh A. Brown.....	138-140
Roadside ditches, erosion control in, principles affecting. J. W. Johnson and Hugh A. Brown..	138-140
ROGERS, ETTA G.: Soil conservation bibliographies. Each issue except August.	
RUNKEL, SYLVAN T.: Furs—A Million Dollar Resource in an Agricultural State.....	237
Russian olive. See Back cover July issue.	
RYERSON, G. E.:—	
Mobilization of Service Equipment for Civilian Defense.....	211-212
Tooling Up for Soil Conservation. With Harry L. Carr.....	113-116, 126
Salmon, white, and humptulips. H. H. Bennett.....	159-168
SCHEFFER, PAUL M.: Beaver on Trial.....	239-241
Schools, cooperation with district in handling farm equipment, Fred C. Burns.....	179-180
Seeding, direct, for growing shrubs. Verne E. Davison.....	242-243
Seedlings, zero to thirty million. Paul Tabor and Arthur W. Susott.....	61-65
SEMPLE, A. T.:—	
Bulldozers and Grade A Milk.....	215-218
Can Farmers Afford To Grow Their Power?..	127
good news for sheepmen.....	106
statement on fattening steers.....	33
Sheep ranges, winter, in Wyoming, utilization of range plants on. Kenneth Fiero.....	281-284
Sheepmen, good news for, statement by A. T. Semple.....	106
Shore erosion on Chesapeake Bay. John Cotton.....	277-279
Shrubs, growing by direct seeding. Verne E. Davison.....	242-243
Silage, grass, and soil conservation. Grover F. Brown.....	19-22
SIME, PALMER R.: Barbed Wire Conserves Soil and Wildlife. With Philip F. Allan.....	263-264
SMITH, DWIGHT D.: Growing Soybeans With Minimum Erosion.....	295-296, 300
Snow water—	
Frank B. Harper and Jack G. James.....	3-9
forecast.....	93
Sod, defense for soil building. C. R. Enlow....	52-54
Soil conservation—	
and grass silage. Grover F. Brown.....	19-22
and war. Angus McDonald.....	228-229
benefits to bobwhite.....	251-252

	Page		Page
Soil conservation—Continued.		TERRES, J. K.: Birds and Conservation. With	
district organization; statistical story of an		E. C. Murdoch.....	303
agricultural movement marching on. J.		Tillage and crop residue management. L. S.	
Phil Campbell.....	182-196	Carter.....	155-158, 173
districts, approval of stockman. William		Tobacco farm, conservation farming on. W. C.	
Lambert.....	230-232	Eagles.....	16-17
districts, cooperation with schools in handling		Tooling up for soil conservation. Harry L. Carr	
equipment. Fred C. Burns.....	179-180	and G. E. Ryerson.....	113-116, 126
food for freedom with. Lloyd E. Partain..	177-178	TOWNS, HOMER G.: Providing for Wildlife in	
grasses for. Edward H. Graham.....	244-247, 250	Farm Planning. With Harvey D. Burk-	
on the land, big-scale demonstration. Ernest		halter.....	254
Carnes.....	279-281	TOWNSEND, M. CLIFFORD: Agriculture's Clear-	
plan in Alabama. J. N. Lowe.....	10-14	inghouse for Defense Activities.....	97-99, 111
program, building through group activities.		Trees, millions of, growing in Michigan district.	
John W. Ford, Jr.....	110	F. E. Charles.....	227
seasonal practices, installation by farmers		TURNBULL, JAMES: Drainage and the Food for	
without technical assistance. H. P.		Freedom Program.....	265-266
Moffitt.....	178	UHLAND, R. E.: The Facts About Conservation	
tooling up for. Harry L. Carr and G. E.		Farming and Yields. See Back cover May	
Ryerson.....	113-116, 126	issue.....	266-269, 276
use of farm machinery and farming methods.			
L. S. Cutter and R. A. Norton.....	100-106	Valimont Farm. D. G. Craig.....	107-109
work, pooling efforts for.....	180-182, 206	VAN DERSAL, WILLIAM R.:	
Soil Conservation Service—		The Perplexing Case of Indian Corn.....	46-51
Cartographic Division and national defense,		statement on—	
work.....	44-45, 58	fishing as man's ancient occupation. See	
neighborhood action in West Virginia, Barbour		Back cover October issue.	
and Upshur Counties.....	301-302	food needs of man. See Back cover,	
photographic services in regional offices....	146-149	August issue.	
Soil, conserving with barbed wire. Philip F.		value of Russian olive. See Back cover	
Allan and Palmer R. Sime.....	263-264	July issue.	
South, pasture development. R. H. Lush....	117-120	Virgin Islands, Soil Conservation Service pro-	
Southwest, water for wildlife. A. E. Borell..	258, 262	grams.....	58
Soybeans, growing with minimum erosion.			
Dwight D. Smith.....	295-296, 300	WALLACE, H. A., Vice President, letter to Mr.	
STATTON, CLEO H.: King Grass Returns to the		Hugh Bennett.....	168
Kingdom of Callaway. With Philip K.		War—	
Hooker.....	273-276	and soil conservation. Angus McDonald..	228-229
Stockman, approval of soil conservation dis-		crop husbandry during. C. R. Enlow..	289-291, 300
tricts.....	230-232	horizon, place of conservation. F. E. Charles..	31-33
Streams, sterile, new life for. Howard C. Hass..	263	needs, farm conservation planning for. E. H.	
Success, effect of man, land, opportunity, and		Reed. See Back cover March issue..	224-226, 232
management. Charles G. Webb.....	94-96	opportunity, article in [British] Soils and	
SUSOTT, ARTHUR W.:		Fertilizers.....	42-43
Terraces and Neighborliness—All Within a		production and the technician. William T.	
Day.....	82-84	Angle.....	294, 303
Zero to Thirty Million Mile-a-Minute Seed-		WARNER, K. F.: Conservation.....	152
lings. With Paul Tabor.....	61-65	Washington, Grays Harbor County, cooperation	
SUTTON, JOHN G.:		with soil conservation districts.....	54-57
Land for More People in the Mississippi		Water—	
Delta. See Back cover February issue..	203	conservation, seasonal practices, installation	
		by farmers without technical assistance.	
TABOR, PAUL: Zero to Thirty Million Mile-a-		H. P. Moffitt.....	178
Minute Seedlings. With Arthur W. Susott..	61-65	for wildlife in the Southwest. A. E. Borell..	258, 262
Technical assistance wanted. F. E. Charles..	66-69,	from snow. Frank B. Harper and Jack G.	
	79, 86	James.....	3-9
Technician, and war production. William T.		Watersheds, farms by, plans in Indiana district.	
Angle.....	294, 303	F. E. Charles.....	18, 28
Terraces and neighborliness within a day.		WEBB, CHARLES G.: Man, Land, Opportunity	
Arthur W. Susott.....	82-84	and Management—Success.....	94-96

	Page
Western States, food - production problems. Frank Kimball.....	223-224
Wheat, transfer to North Dakota for winter storage.....	175
WICKARD, CLAUDE R., Secretary, excerpts from recent addresses. <i>See</i> Inside cover August issue.	
Wildlife—	
benefits on Wisconsin farm	251
conservation, grasses for. Edward H. Gra- ham.....	244-247, 250
conserving with barbed wire. Philip F. Allan and Palmer R. Sime.....	263-264
increase by erosion control practices. A. C. Hawbecker and R. M. Bond.....	255-256
land for conservation surveys.....	264
management on irrigated farms. H. P. Pratt and W. S. Long.....	257-258
plans for Michigan, Fenton Soil Conservation District.....	96
protection by windbreaks, value. Adrian C. Fox.....	259-260
provisions for in farm planning. Homer G. Towns and Harvey D. Burkhalter.....	254

	Page
Wildlife—Continued.	
value of kudzu. Verne E. Davison.....	253
water for, in Southwest. A. E. Borell....	258, 262
WILKINS, L. A.: This Farmer Plans and Works..	15
Wind erosion. <i>See</i> Erosion, wind.	
Windbreaks, value to wildlife. Adrian C. Fox..	259- 260
Wire, barbed, for conservation of soil and wild- life. Philip F. Allan and Palmer R. Sime..	263-264
Wisconsin, northern, human conservation in....	284- 286, 288
Woodland—	
management, more ruffed grouse from. Frank C. Edminster.....	261, 262
money value, surveys.....	175
protection for 10 years. Charles A. Dam- bach.....	252-253, 254, 256
Wyoming—	
ranch in, failure and success. A. E. McCly- monds.....	218-222
range plants, utilization on winter sheep ranges. Kenneth Fiero.....	281-284
sheep ranges, winter utilization of range plants. Kenneth Fiero.....	281-284





JULY 1941

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

July begins Volume VII, another chapter in land defense. Defense of a land increasingly precious under threats from within and from without. (July also sees Winter's waters roll down from the mountains—a bounty for thirsty crops. The story starts on page 3.

UNITED STATES DEPARTMENT OF AGRICULTURE — WASHINGTON

CONTENTS

Snow Water:	Page
<i>By Frank B. Harper and Jack G. James.....</i>	3
The Alabama Conservation Plan:	
<i>By J. N. Lowe.....</i>	10
This Farmer Plans and Works:	
<i>By L. A. Wilkins.....</i>	15
Conservation Farming on a Cotton and Tobacco Farm:	
<i>By W. C. Eagles.....</i>	16
Indiana District Plans Farms by Watersheds:	
<i>By F. E. Charles.....</i>	18
Grass Silage and Soil Conservation:	
<i>By Grover F. Brown.....</i>	19
Graphic Presentation of Land Use and Hydrologic Data:	
<i>By C. S. Jarvis and H. C. Murto.....</i>	23
Conservation Planning for Small Farms:	
<i>By T. J. Cauley.....</i>	26
Book Reviews and Abstracts:	
<i>By Phoebe O'Neill Faris.....</i>	28
For Reference:	
<i>Compiled by Etta G. Rogers.....</i>	Opposite 28
 Front and Back Covers: <i>Russian Olive</i>, Drawn by C. E. Margraff	

WELLINGTON BRINK
EDITOR

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Gunsight Peak in the Elkhorn Mountains is well named. It forms a background of grandeur for the Anthony Lake snow survey course.



The Santa Claus chimney affords ready access to a cabin buried above the eaves. The chimney was developed by R. A. Work, of Medford, in charge of Service snow surveys in Oregon. R. W. Childreth, Service snow surveyor, here is halfway in and halfway out.



SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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JULY • 1941

SNOW WATER

By FRANK B. HARPER and JACK G. JAMES¹

A HUNDRED or more men—and a woman—on skis and snowshoes went far up into Oregon's key mountain ranges during the winter and spring and gathered information, at its source, as to what the coming season's water situation will be after the snow has finally melted and is "showing up" in the streams and springs through the valleys below.

The information is a vital factor in proper irrigated land use and in the economic planning of thousands of farmers on hundreds of thousands of acres of Oregon's most productive lands. It enabled irrigation farmers of all but the southeastern and far-eastern areas of Oregon to know that they are going to be short of water before the summer is out. It gave them the chance to work overtime this spring to get early run-off water over their crop and orchard lands, turn under their cover crops much earlier than they liked, and to decide to summer-fallow large acreages instead of seeding new clover or planting sugar beets or other crops that require late-season water.

It is simple enough to sit beside the radiator or in the warm spring sunshine and read about this business of measuring the snow for its water content. It is a different matter altogether, however, to go along on one of these jaunts—doing work that is everyday routine for Associate Irrigation Engineer R. A. Work, of Medford, and his small army of snow surveyors.

Regional Conservator J. H. Christ in Spokane said that it was "all right with him" for us to make the trip as long as Mr. Work, J. C. Marr, and W. W. McLaughlin were willing to risk letting a couple of "crackers" out on the trail. It turned out that these leaders were willing, and thus we headed for Enter-

prise, Oreg., with heavy clothing, snowshoes, and other gear including zinc ointment and lipstick for snow burn, in sufficient quantity to suggest a trip to the Antarctic.

It was the time of the final spring snow survey, when some 2,000 men in States west of the Mississippi were setting out for the mountains to make what amounts to a "count" of this "lifeblood of the West," as Work calls it—snow. Some of the most inaccessible courses can be measured only once during the season. The majority of them are visited at least twice, for the final spring check and for the midwinter measurements the first of February. Still others are checked once a month from November to May, as on Mount Hood in the Cascades. All of the approximately 100 courses in Oregon are sampled about April 1. Irrigation power, navigation, financial and many other interests with a stake in the snow, and the water it provides, must know before mid-April what they can depend upon so that they can shape their plans accordingly.

An early start was imperative if pictures were to be taken on the 7-mile climb, and also to make the grade up along the East Fork of the Wallowa River past two rather hazardous snowslide areas before the spring sun could loosen the snow clinging to the rocky sides of the trough between the 8,000- to 10,000-foot peaks of Wallowa Mountain. We learned of the snowslide danger after our arrival at Enterprise, while we were busy assembling our gear against the 4:30 a. m. start for Joseph, headquarters of the Northwest's famous Chief Joseph of another day.

Max Wilson, attorney for the Associated Ditch Cos., who regularly takes the Aneroid Lake measurements, joined us at Joseph with his son, Keith. Apparently, Work felt that an extra hand might be

¹ The authors are in charge of current information and visual information sections, respectively, Pacific Northwest Region, Soil Conservation Service, Spokane, Wash.

useful should one of the tenderfeet fail to make the grade.

Our first $1\frac{1}{8}$ mile amounted to 1,400 feet of climbing after which the trail led up through the timber, across ice-covered foot logs and along open snow fields in the direction of the 7,500-foot level of the Soil Conservation Service snow survey course on the edge of Aneroid Lake. Nor did the snowslide precaution prove to be mere guesswork on the part of our leader, although the trip up was without actual incident beyond a momentary scare. When we reached the first slide area, Work instructed us to string out, 50 or 60 yards apart, while crossing.

"Is it," we asked, "because too many persons walking across together would set up vibrations and jar loose the snow above us?"

"Partly, yes," he replied. Then he added comfortingly: "And, of course, this way, if a slide comes, you lose only one or two men, not the whole party."

Work was breaking trail, followed by James in his ski tracks. Next, Wilson senior on bear-paws, then Harper on Alaska webs, and Wilson junior bringing up in the rear on skis. Work and James were across and Max Wilson nearly so; Harper was half way over and wondering how he could run in his webs. Young Wilson had just started. A low whistle sounded a warning. Up above, the snow was starting to move in little ripples on the smooth white surface.

"Get across!" came the more imperative warning.

Ragged, broken trees and stumps and other tall trees partly uprooted, in a big fan-shaped patch below the trail to the river, testified to the power of countless tons of sliding snow that had let go at this very spot a couple of years before. The order to get across quickly was good advice, although this time our slide fortunately turned out to be a dud.

We entered the well-constructed, amply stocked Soil Conservation Service shelter cabin through the attic door well above the 1940-41 light-snow height. It was too late to make a visit to the snow course; besides, there was the business of building a fire, shoveling steps to the lower door, carrying water from the spring-fed creek, cooking dinner from the provisions in the frost-proof concrete cupboard beneath the wood range, and making down sleeping bags on table, storage chest, and even the floor to accommodate five in a cabin with bunks for the normal survey crew of two.

Work and Irrigation Attorney Wilson made harmless bets on how deep the snow would be on the mountain-meadow course and how many inches of water the snow tube and scales would show. Young

Wilson finished his self-appointed tasks as chief cook. James snapped an occasional picture of snow surveyors in the field. Harper made notes as the others discussed the objectives of the survey:

"You can't tell how much snow and water there is up there merely by looking out the window," Work was saying as he glanced toward the snow-banked window for emphasis.

"I agree," replied Wilson, "and I know that our farmers count on these surveys. In fact, I don't believe any place in the State depends so much on the snow surveys as the upper part of the Wallowa Valley with its 17,000 acres or so under the ditch. Our land will net an average of \$30 an acre, in peas, grain, hay, and all other crops. Although a low water content means that the farmers must turn to summer-fallow to make the water reach—and every thousand acres of summer-fallow subtracts \$30,000 from their year's returns—yet if they planted without having this snow forecast information, not only would they lose this income but also their seed and labor."

Someone stepped outside to get the snowshoes, and reported that snow was falling.

"The difference of only a few inches in the snow's water content means thousands of dollars to our farmers," Wilson took up the cue as he reloaded his pipe. "Before 1929, we had to depend on somebody's guess—not a very reliable method. I believe that the snow survey work is worth fifty times what it costs. Our farmers' investment includes the \$160,000 storage reservoir, with a 45,000-acre-foot capacity; and every foot of that storage comes from the Wallowa River watershed where these snow surveys are made."

Because of donations of time and other services by 23 cooperating State and Federal agencies, power companies, and other public and private interests in Oregon, where all the snow surveys are correlated by the Soil Conservation Service in cooperation with the State Experiment Station and the State Engineer, the cost now is almost nominal. It seems negligible even as contrasted with the worth of the results as described by Wilson during our swing through the Wallawas, the Elkhorns, the Blue Mountains, and the Southern Cascades and into the valleys of the Malheur, the John Day, the Grande Ronde, and other rivers and drainage basins.

Snow surveys were started in Oregon in 1928, through the State Engineer's office. A year or so before that date the California-Oregon Power Co. had begun making measurements, although the data were not made available to farmers until after 1935 when the United States Department of Agriculture, through



How much? With tube and scales, the snow surveyors measure and weigh the snow on the permanently marked course to find its depth and water content, as an index to the storage on the watershed and as a basis for forecasting the summer's supply of water for irrigation, power and other uses. A. E. Kenworthy takes the sample; R. A. Work makes the record.



The snow was light this year. Otherwise it would be banked even higher around the shelter cabin at the end of the trail. R. A. Work and Max Wilson here approach the Aneroid Lake snow survey cabin in the Wallowa Mountains.

the Bureau of Agricultural Engineering, became the national coordinator of all snow survey work in order to assure complete and continuous records. At the same time, all the State courses, many of which had been dropped in the early 1930's, were reestablished and several new ones were set up.

Today, the snow measurements are made by United States Forest Service and National Park Service rangers, Geological Survey stream gaugers, power line patrolmen, Fish and Wildlife Service hunters, county watermasters whose budgets include snow survey funds in counties affected, irrigation district managers and many others. They cover approximately 4,000 miles of rough mountain terrain each winter, with one trip alone in the Cascades calling for 120 miles of travel on skis. The Soil Conservation Service has 13 snow survey cabins in the Oregon district, each equipped to shelter two men for 2 or 3 weeks in an emergency—one man never goes alone on this hazardous mission. It cooperates with the Forest Service, the Geological Survey and others in stocking 17 additional cabins belonging to these agencies.

Through the still falling snow—about the first of any consequence since early February—we went across frozen Aneroid Lake early in the morning to the snow course. Each sampling station is marked by bright black-and-yellow signs on tall red-and-yellow steel posts set in concrete; thus every measurement is certain to be taken at the same spot from year to year. The 1¾-inch aluminum tube was lowered

77.8 inches before its saw-tooth end struck the dead grass and black unfrozen soil below. Nearly 6½ feet of snow seems enough to suit anybody, but it was almost 10 inches less than the 1940 spring measurement, which of itself was nothing to boast of. The hand scales, correspondingly graduated to show the inches of water in the column of snow brought up in the tube, revealed that the average water depth was but 28.4 inches.

Upon our return to Enterprise, Watermaster Steele cut short his Sunday dinner to pick up the snow measurements. In the 13 years since the Aneroid Lake surveys were started, only four surveys have shown snow depth and water content lower than those of 1941. This is not as discouraging as it seems, however, because the increased early season storage in Wallowa Lake and the expected stream flow from the East and West Forks that supply it, warranted a forecast for the summer of 6,000 to 7,000 acre-feet more water for the upper valley's ditches.

"The snow survey information is most important from the watermaster's point of view," Steele explained. "Farmers are constantly asking how much water there will be. If the snow is short up there, the watermaster must work the water around in order to make a fair distribution."

The trip was to disclose, however, that to the west and south where the mountains missed the late snow-laden California storms, there was cause enough for worry in 1941. The snow lay only in

inches-thin patches on Blue Mountain summit, where normally it is measured in feet at the same time of year. We visited this snow course with Superintendent John Updegraff of the Warm Springs Irrigation District, and his daughter, Mona, who more than once has made the 50-mile trip on skis to the two other courses her father measures regularly. The snow crop was shorter than usual at Anthony Lake up in the Elkhorns, where District Forest Service Ranger A. E. Kenworthy remarked that "the farmers can hardly wait until I get to town, to learn the official snow depth and water content figures."

At Crater Lake, the 8 feet of packed snow on the level, as measured by Ranger Wilfred T. Frost of the National Park Service, seemed ample enough to the uninitiated. In 1938 there were more than 15 feet of snow, and nearly 62 inches of water for the thousands of irrigated acres and the power plants below, as contrasted with less than 40 inches of water this year. At Seven Lakes, 16 miles uphill into the Cascades west of Fort Klamath, where James accompanied

R. W. Childreth and G. F. Sturdevant, snow surveyors for the Soil Conservation Service and the State experiment station, the snow also was short. After the grueling trip over rough, frozen snow they found that the "Santa Claus chimney" tower designed by Work for finding and entering the snow survey cabin in deep-snow years was exposed almost down to the roof of the cabin.

Winter was leaving the mountains early, with a proportionate shortage in late-season snow, and the bears were coming out of hibernation before the usual time. One gaunt, hungry yearling stood on the snow begging for a handout from passing cars along the Crater Lake road, where an older bruin had blocked traffic between the high snowbanks a few days before, until Park rangers herded him off into the timber. A fresh track, nearly two handspreads across, was seen on the trail to Seven Lakes.

The short-wave radio at the Medford office brought similarly unwelcome news of snow shortages from other snow surveyors within a radius of 250 miles.

Snow surveyors work out their computations at the earliest possible moment after taking the measurements, to have accurate forecast data for prompt relaying, sometimes by short-wave radio, to irrigation, power and other interests waiting for them. R. A. Work, left, is doing his figuring on a piece of board; Max Wilson, right, attorney for the Associated Ditch Companies in the Wallowa Valley, completes density and other tabulations from measurements taken an hour earlier on the Aneroid Lake snow course in the Wallowa Mountains.





A close-up of sampling. The accuracy of many such measurements determines the accuracy of the water forecasts.

"I have some snow measurements for what little snow there was to measure," came one report.

"The water is so short," another surveyor complained, "that the creeks look more like the last of April than near the first of April."

Good or bad, the figures were relayed by the next mail to waiting watermasters, irrigation district managers and others in the territory affected, to be considered along with stream-flow and other available data in the half-dozen water forecast meetings held in different parts of the State before the annual mid-April meeting of the Interstate Columbia Basin Forecast Committee at Portland. There, Oregon, Washington, Idaho, and Montana representatives were cautioned that the 1941 water-supply conditions of the Columbia River basin might be among the worst in recorded history.

The snow-water forecasts are recognized as accurate and dependable by the farmers and other water users. One hundred and twenty of them, covering most of Oregon's important watersheds, were issued between

July 1, 1938 and June 30, 1940. About 400 copies of the final April 1 forecast were mailed from Medford this year. That the Oregon snow surveyors, with their colleagues in other western States, are doing a pretty good job of taking the guesswork out of their business is indicated by the fact that in 1940, 85.4 percent of their forecasts were 80 percent correct or better. Mr. Work frankly considers this a "not half-bad showing" when taking into account such unpredictable additional factors as spring and summer rains, chinook winds, rate of thawing, evaporation, etc.

A dozen or more men on the "consumers' " end of snow surveying bore witness to this as we took a hurried informal poll across the State:

Harvey McAllister, farmer near The Dalles, remarked as follows: "I had planned on planting some more alfalfa this year, but now I'll not do it. Every forecast I've watched thus far has been borne out, even if some of the old timers do still say it's all tommy-rot."

Ed Judd, manager of the Medford and Rogue River

Valley Irrigation districts had this to say: "The snow measurements will check accurately to within 5 or 10 percent, if the spring is a normal one. By forecasting a short water year, we can keep the farmers from making expenditures for seed, labor and use of their land."

George Cochran of La Grande is a member of the President's Reclamation Repayment Commission, and vice-president at large of the Oregon Reclamation Congress. He lamented the fact that the LaGrande Valley water table has dropped as a result of the draining of the sloughs; he censured waste of irrigation water through failure to use soil and moisture-conservation methods. "The snow survey is certainly a big thing," he said. "The county agents should send to the farmers, along with the forecasts, statements on how to arrange their planting to meet the water conditions. It is a matter of dollars and cents to the farmers."

Ray Larson of Nyssa, who is district manager of the

Amalgamated Sugar Co., made this statement: "About the first of January I start watching for the snow survey reports. If they are not in by the fifteenth, I begin to wonder where they are. Last year, had it not been for this information, we would not have planted an acre in the Brogan area; but with the report we went ahead with about the usual acreage, and it worked out all right."

E. Reed Carter, secretary-manager of the Grants Pass Irrigation District, was found early in the morning in the office of County Watermaster Tom R. Pearce, studying snow-survey figures we had heard coming in over the radio at Medford the evening before: "If we had listened more to the snow survey forecasts last year, our estimates would have been closer. We plan our operating season from the snow information. We have found that the estimates in this county since 1937 have been within 2 or 3 percent of the actual figure."

The snow survey courses of the western mountains are far off the highway—and no ski lifts to haul the surveyors up. R. W. Childreth leads the way and G. F. Sturdevant follows, on a trail in the southern Cascade Mountains west of Fort Klamath.



THE ALABAMA CONSERVATION PLAN

By J. N. LOWE¹

WHILE attending a training school for AAA committeemen and soil conservation district supervisors in Pike County, Ala., I got a new conception of how farmers may make their soil conservation district the instrument for solving many of their problems. This training school, a part of the program for developing the "Alabama Plan," was held in the Wiregrass Soil Conservation District in the southeastern part of the State where the agriculture consists principally of growing cotton, corn and peanuts, and raising hogs.

The type of agriculture of the area involves many complicated problems. There is need for winter cover following peanuts dug for market; for sodlike crops in the rotation; adapted winter legumes that produce seed regularly; adequate fencing; early summer grazing for hogs; for pasture development; for proper disposal of run-off water, and other sound farming practices.

The encouraging feature of this gathering of farmers was the willingness of the group to "tie into" the problems and use all information at hand for their solution. These farmers are leaders in their respective communities and they were given the responsibility of helping their neighbors to determine a solution to the conservation problem.

¹ Assistant chief, regional agronomy division, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

Kudzu being utilized for temporary grazing for hogs on critical slope formerly cultivated. Old bench terraces are in the background.

It has been wisely said that if the soil is to be conserved, it will be through the efforts of those who occupy the land. As I observed this group in action, I became convinced that the job can and will be done when satisfactory solutions to the problems are demonstrated.

It is recognized in the Wiregrass district that the low bottomlands are the most desirable sites for pasture. Many farms have very little, if any, such land available. In studying this problem, it was found that M. W. Redd, a dairyman near Ozark, has developed a practice that will help solve this problem. On a well-fertilized loamy sand hill he uses a mixture of oats and vetch for winter grazing; for summer grazing he uses Bermuda grass. The oats-and-vetch furnishes some grazing during the winter and early spring and is harvested later for hay. The Bermuda grass provides excellent grazing throughout the summer.

Last fall, farmers cooperating with the district planted 13,000 pounds of blue lupine seed for winter cover and seed production. These plantings are being studied in an effort to solve the problem of producing winter legume seed locally. The winter legumes grown in the South consist mostly of vetches and Austrian winter peas. These crops are not dependable seed producers in this section. A winter legume that consistently produces seed under Southern conditions would be extremely valuable in the conservation program.

The training school in Pike County was a 3-day





Meadow outlet for water disposal. Note terraces entering meadow strip from cultivated land on each side.



meeting, conducted jointly by the county agent, the AAA administrative assistant, and the Soil Conservation Service work unit technician. The first two days were spent in the field studying two farms, one that had been planned by Soil Conservation Service technicians and on which conservation practices had been established, and the other an unplanned farm on which virtually no conservation measures had been established.

Each member of the training group was given a land-use map of the planned farm and as the group

Crotalaria seeded in March on small grain for soil protection and improvement.

walked over that farm each phase of the planned program and each practice was explained and discussed. The unplanned farm was used as a "problem" farm and each one present was given a work sheet and a base map of the farm and asked to prepare a suggested land-use map, showing locations he would propose for waterways, pastures, and perennial strips of kudzu and *Lespedeza sericea*. Each member of the group also was asked to decide which fields should be terraced

and to discuss the cropping practices necessary to maintain and improve the land remaining in cultivation.

The last day was spent in conference, working on the problem farm. This farm was in a run-down condition and much of it was unfit for cultivation. Each member of the group submitted his work sheet and suggested plan to the chairman and he, in turn, selected the papers at random. As each man's paper was brought up for discussion he was asked to outline his plan for the problem farm on the large map provided for that purpose. When each man had finished his plan, the group was given an opportunity to discuss it. At times the discussion became rather warm, but these farmers were learning what their conservation problems were and how to solve them.

It developed that a large, good-natured committeeman owned the problem farm. The uncomplimentary remarks directed at his farm had not disturbed him in the least because he was eagerly seeking a workable solution. From his neighbors he had received many suggestions, some good and some bad; and when given a chance to speak he did a very good job of separating the wheat from the chaff in formulating a plan for development on his run-down land.

Briefly this is how the "Alabama Plan" is functioning at the grass-roots level, where conservation leaders are being trained in every community in the 67 counties of the State. Those in charge of the AAA program are conscientiously seeking methods for getting more conservation on the land. With this in mind, the Alabama Agricultural Conservation Committee has formulated what is known as the Alabama Farm Conservation Plan. The plan was approved by the Agricultural Adjustment Administration; members of that agency have recognized that worthwhile accomplishments usually are made according to a definite plan.

The minimum conservation requirements under the plan, or in other words the 5-year goals, are as follows:

1. To grow on cropland *each year* an acreage of erosion-resisting and soil-conserving crops equal to at least 25 percent of the cropland.
2. To terrace properly and maintain terraces on all cropland on the farm which is subject to erosion and is not in permanent vegetative cover.
3. To establish and maintain perennial soil-conserving crops approved by the State AAA Committee, including kudzu, *Lespedeza sericea*, and alfalfa, on at least 1 acre for each 15 acres of cropland.
4. To establish and maintain permanent pasture on at least 1 acre for each 15 acres of cropland.

A system of points for each of the requirements

was worked out so that each farm could qualify by carrying out one-fifth of the total requirement in 1941. For each 2 percent by which the 1941 goals are not met the payments with respect to cotton, tobacco, wheat, and potatoes will be reduced 1 percent.

It was realized that to make such a plan effective it would be necessary to coordinate the thinking of agricultural workers and leaders, and to develop in the minds of the people a genuine philosophy of conservation. Therefore, the workers at the State and area levels were the first among those to be given a training course. The plan for conducting the educational program was worked out by representatives of the Alabama Extension Service, the AAA and the Soil Conservation Service.

The plan included a training school for those in the State and area levels; 12 district schools for district and county workers, including the 3 county AAA committeemen; a school in each county for AAA committeemen and the soil conservation district supervisor; and, in addition, farmer-training meetings in every community of the State.

So far as I know, this is the first full-fledged, State-wide cooperative attack on the conservation problem that has been made. Everyone from the State Administrator to the farmer had a definite part to play. This is obviously a big undertaking. However, we felt that the late W. D. Bently, director of extension in Oklahoma, "had something" when he said, "If you get in a rut and can't get out, improve the rut." We undertook the task, believing that it could be done, and realizing, of course, that many changes and adjustments would be necessary during the 5-year period.

It was necessary for agronomists and engineers to prepare educational material outlining recommended conservation practices that could be used to meet the conservation requirements under the plan. At the close of the State school the technical and administrative personnel were divided into three teams who conducted the district schools. Each team included an engineer and an agronomist, one of them from the Extension Service and the other from the Soil Conservation Service. These men discussed the technical phases of the program and conducted field tours. In addition to observations of established conservation practices in the field, a well-selected set of slides was used to illustrate further the conservation practices necessary to qualify for full payment under the AAA program.

Educational authorities tell us that the most effective method of teaching is through the eye. Meeting



places for the district schools were thus selected so that farms with established conservation programs could be visited. The field trip provided an opportunity to bring administrative personnel and farmers alike into direct contact with the conservation problem on the land. After all, it is hard to administer a program if you do not know what the end product should be.

The enthusiasm with which the farmer-committeemen participated in the discussion along with their wholehearted approval of the plan was enough to convince anyone that they meant business. These farmers expressed the need for a planned conservation program and one committeeman said, "I don't know much, but what I know, I know as well as anyone." When asked what he knew he replied, "I know that this program should have been started 5 years ago."

Those who attended the district schools are responsible for teaching local leaders or community committeemen how to assist farmers in filling out their work sheets, showing what the 5-year and 1941 goals are and how these goals are to be reached. They also assist farmers in making an inventory of the practices already established on the farm. Judging from the group I saw in action in Pike County, the responsibility has been assumed and they are determined to do something about their problems on the land.

Throughout the planning, it was brought out that the requirements of the AAA program are not unreasonable, since the farmers who have signed soil conservation district agreements have obligated themselves to establish practices equivalent to more

Seed patch of blue lupine, a promising winter legume in parts of the lower South.

than twice the requirements set up by the AAA.

The farms planned by the Soil Conservation Service on which conservation practices were established have been of inestimable value in the educational program. These farms have made a tremendous contribution as stepping stones in a mass attack on soil conservation problems. They are patterns which guide community committeemen in assisting farmers to make foundation plans for their farms and to establish some of the fundamental conservation measures. In the main, these fundamental conservation measures are the permanent fixtures around which complete farm conservation programs will be developed. As to the job itself, it is evident that the old song, "when the work's all done next fall," has little application in this plan. A trained survey crew is needed for each community in the State to help do the terracing, and a large volume of planting material will be necessary before the vegetative program becomes a reality. Furthermore, schools had to be conducted to teach young farmers how to plan water-disposal systems. Other schools were conducted to show agricultural workers and farmers how to dig, grade, and handle kudzu crowns.

This program will require 50,000,000 or more kudzu plants annually during the 5 years. No such volume is available from commercial sources and it therefore has been necessary to mobilize in an orderly manner the planting material from all sources. Each county group assumed the responsibility of making



available a supply of planting material for use by the farmers of the county. As a result of this agreement the AAA through the conservation-materials project has furnished 18,000,000 kudzu crowns, and the farmers have secured a like amount from local sources. Many of these crowns were dug from plantings made by the Soil Conservation Service on project and camp areas. In addition, the Soil Conservation Service through the district program has provided 8,000,000 kudzu plants to cooperating farmers in Alabama.

On the other hand, in spite of the efforts of the State agronomy committee and others, the available supply of seed and other planting material was only a fraction of the needs. The Alabama farmers would have used the entire national supply of *Lespedeza sericea*, common and Kobe lespedeza, Dallis grass and white Dutch clover seed, had they been able to obtain it at a reasonable price.

It has been interesting to watch the program develop. One of the most striking changes is in the way of thinking of agricultural workers. Most of us in the beginning had little conception of the time, skill and material necessary to execute such a large-scale action program.

It is significant to note that this plan is forcing those of us who have responsibility for its success to size up the entire job that is ahead. The enormity of the

Beef cattle grazing on permanent pasture of white Dutch clover, Dallis grass, annual lespedeza, and Bermuda grass.

task of the future allows little time for "crowing" over past accomplishments.

FSA CLIENTS BECOME CONSERVATION FARMERS

County rural rehabilitation supervisors in Ohio have become proficient at laying out contour strips, and in planning other erosion control practices, as a result of close cooperation between the Farm Security Administration and the Soil Conservation Service. The Farm Security Administration teaches its clients that to rehabilitate farm families it is usually necessary first to rehabilitate farm lands. A series of 1- and 2-day schools, sponsored by FSA and with the active participation of SCS technicians, served as the springboard for this cooperation.

FSA supervisors went into the field and obtained first-hand information on conservation planning. Now they take their clients to the field, instruct them in observing erosion and studying ways to check it. With these practical educational steps as a prelude, FSA is insisting more and more that conservation practices be established wherever possible on all client farms.—
R. R. Barker.

THIS FARMER PLANS AND WORKS

By L. A. WILKINS¹

IN MISSISSIPPI the old timers thought of grass as something to be fought from dawn to dark during the crop season, but E. N. Nolen, farmer near Coffeeville, is cultivating grass and making it work for rather than against him.

When he sought the assistance of SCS-CCC camp technicians in working out a conservation plan for his severely eroded 240-acre farm, Mr. Nolen knew that he needed feed for his cattle. This was early in 1936. The house he lived in was in need of repair—part of it had a dirt floor—but he knew that his most urgent need was feed for his dairy cows and that a new floor for his house could come later. He spent money for fertilizer for use in establishing perennial forage, knowing that his small herd of dairy cows, if well fed, would pay for the remodeling of the house. The neat rock-veneer home shown on this page represents the fruits of the toil and sacrifice of a farmer and his family who knew what they wanted and were willing to work and plan for it.

In planning his land use, Mr. Nolen did not hesitate to convert cultivated cropland to pasture and perennial forage. He reduced his cropland acreage 21 percent, and increased acreage of pasture 28 percent. He planted 21 acres of kudzu, and also 5 acres of

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E. N. Nolen examining the stand of kudzu that has just been fertilized and disked at the beginning of its third growing season. He harvested 21 tons of hay from 10 acres of kudzu in 1940.



Increased returns from dairy cows as a result of more pasture and home-grown feed financed the remodeling of the Nolen home.

Lespedeza sericea, which will be further increased with 250 pounds of seed harvested in the fall of 1940.

Although woodland acreage had to be reduced by 25 percent to make room for the pasture and perennial forage needed on the farm, Mr. Nolen hopes for an increase in his timber income because he has excluded livestock from his remaining woodland and he is using other improved management practices provided in his farm plan.

This farmer's program is beginning to bear fruit: His average annual income from milk and cattle sold during the 3-year period, 1938-40, was \$66.07 more than in the 3-year period, 1935-37. This increase was the result largely of improved grazing in pastures. Likewise, the returns from perennial forage crops are beginning to be a factor in his income: Of the 1937 planting of kudzu, 8 acres yielded 8 tons of hay in 1939, and 21 tons were harvested from 10 acres in 1940.

As a result of improved cropping systems in which legumes were grown, the average yield of corn was 500 bushels on 38 acres during the last 3 years, as compared with an average of 450 bushels on 47 acres during the 3 years, 1935-37.

Mr. Nolen has done an outstanding job under unusual difficulties. He started with a very poor farm and with little financial resources, and already he has achieved a degree of success that in the beginning did not appear possible.

TIMELY ARTICLE

"In the last war we plowed more and wasted much. Now, we will plow less, yet grow more." Thus writes F. E. Charles for the August issue of this magazine.

CONSERVATION FARMING ON A COTTON AND TOBACCO FARM

By W. C. EAGLES¹

TO MY knowledge this North Carolina farmer has not built any unusual mousetraps, yet the world is beating a path to his door—to study the secret of his success in making better use of his 101-acre tobacco and cotton farm. The farmer is H. B. Cooke, of Franklin County.

In 1936, when technicians of the Franklinton project of the Soil Conservation Service began helping him to develop a conservation plan on his farm, Mr. Cooke had 40 acres of cropland, 11 acres of idle land, and 50 acres of woodland. He had been growing a small acreage of oats which he cut for hay, while he depended largely upon corn fodder for forage. The corn fodder was pulled by hand. Approximately one week of man labor was spent for each ton of forage obtained.

His land was not terraced, and he did not follow any systematic rotations. His pasture consisted of 2½ acres covered with a partial stand of second-growth pines and broomsedge. As a result of his farming practices, the soil of his farm was being washed away and acre yields of crops were low.

Today, after less than 5 years of soil conservation farming, all of Mr. Cooke's land is in use. He is

¹ Assistant soil conservationist, Upper Cape Fear Soil Conservation District, N. C.

following a systematic rotation under which at least half the cropland is kept under protective vegetative cover. He grows 12 acres of lespedeza in his rotation. Approximately two-thirds of his lespedeza is combined for seed, and the remainder is harvested for hay. He combines from 5 to 8½ acres of grain, thus leaving the straw on the land instead of removing it for hay as he did formerly.

Largely as a result of the lespedeza straw that is turned under, his acre yield of seed cotton has been increased from 700 to 900 pounds and the yield of corn from 16 to 30 bushels an acre. By almost doubling his acre yields he is now producing slightly more corn on 6 acres than on 11 acres before the plan was developed.

Since bright tobacco does not fit into a rotation with legumes, Mr. Cooke is growing his in a rotation with rye which he harvests for seed. His acre yields of tobacco have increased to such an extent that the total yield is only slightly reduced by an allotment cut from 8 to 5.6 acres under the AAA program.

Whereas no systematic effort was made to control erosion before the conservation plan was written,

Lespedeza sericea is giving effective protection in this waterway on the Cooke farm.





Mr. Cooke now has all of his cropland terraced and his rotation arranged in strips on the contour for more effective erosion control. Proper terracing, and contour tillage with improved row arrangement and with the protective vegetation in the rotation arranged in strips at intervals to break the slope, have greatly reduced the loss of soil and water from his cultivated land.

As a part of his water-disposal system, Mr. Cooke has established a 3-acre meadow outlet in which grasses and legumes were planted in a mixture. In addition to providing safe water disposal from terraces, this meadow outlet produces a large part of the hay for the two work animals and one milk cow kept on the farm.

In place of the 2½ acres of low-grade pasture that he had before the plan was put into effect, Mr. Cooke now has 5 acres of improved pasture that produces approximately 40 percent of the feed for the livestock kept on the farm. Furthermore, this farmer is now producing approximately the same amount of corn, and only slightly less cotton and tobacco, than he did prior to planning. He is doing this on 8.4 acres less land. The land that has been taken from row crops is being utilized for small grain and other crops, principally lespedeza.

Income on this farm has been considerably increased through the following: production of the wheat needed on the farm; the sale of approximately \$50 worth of poultry products, 75 to 100 pounds of butter, 60 bushels of sweet potatoes, 1,000 pounds of lespedeza seed, an average of 7 pigs, \$30 worth of meat, and a small amount of corn and small grain each year.

Mr. Cooke gets a large part of his hay from this meadow strip outlet which safely disposes of water from terraces on the adjoining sloping fields.

He is making a larger income and is improving rather than depleting his soil resources. Although this farmer lives at the end of a narrow, unimproved road approximately one-half mile from the main highway, hundreds of visitors come to see the results of the outstanding job he has done on his family sized farm.

OTHER AGENCIES ASSISTED

The following quotation is taken from the last semi-annual report of the supervisors of the McIntosh Soil Conservation District, Oklahoma:

"The NYA furnished the district with 108 man-days of labor, and these people were used to assist the planning technicians on the district staff.
* * * The WPA worked an average of 60 men on 63 district farms. For the most part they were used in planting trees and grass, controlling gullies, assisting in pond construction, pasture clearing, and stabilizing terrace outlets. During that time 4,102 man-days of labor were used on these and similar jobs."

BUILDING A SOD DEFENSE

C. R. Enlow begins his next month's article: "Our boys need to be conditioned for defense. So does our soil."

INDIANA DISTRICT PLANS FARMS BY WATERSHEDS

By F. E. CHARLES¹

IN ADDITION to the customary single-farm plans, the Knox County Soil Conservation District in Indiana is taking applications on a small-watershed basis, with the aim of solving both erosion control and drainage problems.

Under the watershed plan, district supervisors require all landowners with property adjacent to the drainage ditch to sign the application. The application also gives right-of-way for a drainage survey. When the owners sign, they are told that they will be expected to consider erosion control as a part of the project, because erosion on the upland will cause siltation and destruction of the drainage ditch.

A conservation survey is conducted at the time of, or before, the drainage survey, and land-use capability maps are prepared for the entire watershed.

"After a preliminary drainage survey has been conducted a group meeting is held," Lester H. Binnie, district conservationist, explained. "Both drainage and erosion control are discussed. Thus far it has been possible to complete erosion control plans for

most farms, and in some instances to put them into effect, before drainage has been accomplished. The supervisors do not expect 100-percent agreements on erosion control—although in the first watershed, about 1,200 acres, all the landowners are cooperating in erosion control. In this instance eight farms are involved."

Ten applications of this type have been received, the number of land owners involved ranging from 6 to more than 50 per watershed. Of the first 50 farm agreements, about half were on the watershed basis. Cooperation is being obtained from the State and County Highway Commissions and from a railway company.

The common problem, drainage, is an asset to completion of farm planning for erosion control, Mr. Binnie finds. It facilitates group education and action. Two or three group meetings are held in a watershed

(Continued on p. 28)

The common soil types are particularly susceptible to erosion. Soil washes easily, leaving raw areas like this.

¹ Chief, regional information division, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.



GRASS SILAGE AND SOIL CONSERVATION

By GROVER F. BROWN¹

THE term "grass silage" is generally used to refer to silage made of any green feed that can be used for hay. We often speak of grass silage as including not only grass but legumes, or a mixture of grasses and legumes; sometimes small grains are included, or even pasture surpluses that can be mowed and put into the silo for later feeding. The preservation of grass by placing it in vertical or trench-type silos is not new, but it is only recently that its importance has been recognized in this country. Intensive study is now being carried out to determine the best method of preserving forage. Yields and the quality of feed produced by different grasses and legumes are also under scrutiny. A dense growth of grasses and legumes has long been recognized as the natural method for conserving and building better soils, and those interested in soil conservation look to grass silage with a great deal of confidence.

Methods.—At least four different methods for making grass silage are used in this country at the present time. All have their peculiar characteristics. These four general methods are usually known as (1) ensiling without any preservative, (2) the A. I. V. method, (3) the phosphoric-acid method, and (4) the molasses method. The last-named method probably is used much more extensively than the other three in the United States.

In preserving grasses and legumes without the addition of acids or carbohydrates, careful attention must be given to the moisture content of the material at the time of ensiling. About 65-percent water appears to be the optimum moisture content for this purpose. It is very difficult for the practical farmer to obtain this optimum, especially under varying acreage and weather conditions. Spoiled silage results oftener from this method than from others involving the addition of some kind of preservative. In making good silage without any preservative, it is necessary that the hay be allowed to lie in the swath and wilt for 2 to 4 hours after cutting on a good drying day, and longer on a poor drying day. The material must be chopped fine. In filling the silo the silage must be kept leveled and must be well tramped to expel the air. Partial drying of the hay in the field diminishes losses caused by fermentation, and the resulting silage usually has a good odor; on the other



Harvesting grass silage. (Photo courtesy of D. B. Johnstone-Wallace, Cornell University.)

hand, it is claimed that the surface spoilage and loss of carotene are increased by this method.

The second or A. I. V. method, calls for the addition of about 12 to 18 gallons double normal solution of five parts hydrochloric acid and one part sulphuric acid to each ton of green material. The cost for the acid usually is from 90 cents to \$1.20 per ton of silage. In feeding this silage, about 1 ounce of limestone is fed with each 15 to 20 pounds of silage to offset the acidity. It is claimed that this method of ensiling conserves most of the carotene content of the green feed.

In the phosphoric acid method, third on the list, phosphoric acid is used at about the rate of $1\frac{1}{4}$ gallons (16 pounds) to each ton of green material. One advantage claimed for this method is that any phosphoric acid not assimilated by the digestive processes of the animal passes on to the manure to increase its phosphorus content. If a cow eats about 40 pounds of silage a day, it is claimed that her manure contains an amount of phosphorus about equal to that in a pound of superphosphate sprinkled in the gutter. The cost of phosphoric acid is 55 to 60 cents a gallon, making the cost per ton of green material ensiled about 70 to 75 cents.

The molasses method of ensiling is widely used. It calls for the addition of 40 to 90 pounds of blackstrap molasses to each ton of green material ensiled, depending on the relative proportions of grasses to legumes in the mixture. Usually the molasses is fed into the ensilage either at the bottom of the blower or the chopper or at the top of the spout that dumps the material into the silo. Sometimes it is sprinkled on the silage in the silo with a can. Since molasses is a concentrated source of carbohydrates, it furnishes material for active fermentation similar to that which takes place in corn silage. This fermentation results

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in the formation of acids which act as preservatives. The cost for molasses usually runs about a cent per pound in barrels, depending on the freight rates.

Feeding Qualities.—Most experiments show that silage made from good materials and properly ensiled by any of the four major methods is of high quality. Some experiments tend to indicate that one method is superior in some respects to the others, but it appears that any of them, if used properly, will produce good feed. The final selection of the method is largely a matter of personal opinion, costs, and the equipment and materials available. It has been pointed out by the Wisconsin Agricultural Experiment Station that there is a beneficial effect from the plant juices in grass silage that is lost when the material is cured as hay.

One of the most important claims made for the feeding of good quality grass silage is its effect upon the carotene content of the milk and improvement in color and flavor. In fact claims are made that alfalfa molasses silage is almost equal to spring pasture in putting yellow color in milk and is equal to or better than pasture in producing milk of fine flavor and high resistance to the development of oxidized flavor. The market milk handlers in parts of the New York market are urging their grade "A" producers especially to feed grass silage during the winter months to maintain the summer quality of the milk.

Reports from the various experiment stations and practical dairymen are not in agreement regarding the palatability of silage made from the different methods. Some reports show that phosphoric acid silage is less palatable than molasses silage, while others indicate a higher milk color and carotene content in silage preserved with phosphoric acid. A survey of the work being done at the various experiment stations gives the impression that the quality and feeding value of the silage depends more on the quality and feeding value of the product at the time of ensiling, plus the care used in the ensiling process, than upon the method or preservative used.

In most of the feeding trials, good legume or alfalfa silage has been fed at the rate of 3 to 4 pounds, and hay 1 pound, per hundred pounds of liveweight. It is the opinion of most feeders that the grain ration may be cut to at least 12 percent when alfalfa silage is being fed. On farms where good alfalfa or other legume silage is raised, this may materially lower the cost of milk production.

Cost Factors.—The cost of producing grass silage, as compared with corn silage, is very largely determined by the equipment available for handling the material on any particular farm. A great deal of hard

labor is involved in handling green material for grass silage unless proper machinery is used. However, anyone who all day long has wrestled heavy green corn bundles on the wagon and through the cutter will appreciate that this job itself has its tiring moments. Furthermore, equipment for easier handling of green material for ensiling is now on the market, and it reduces the physical labor to the point of equality with corn silage. One machine, used quite extensively in the northeastern States last summer, cut the green hay, chopped it into short lengths suitable for ensiling, and elevated it into a wagon or truck ready for delivery to the silo. There it was run through the regulation blower, where the preservative was added, or else run into the silo by an inexpensive elevator powered by a two-horse motor. The same elevator was used for removing the material from the silo, a job not easy in itself in winter when the silage is frozen.

The new portable grass chopper patterned after the small combine will doubtless increase use of grass silage as a method of preserving winter and supplementary feeds. Some of the older hay loaders are not sufficiently strong to handle the green weight. New equipment, designed especially for this heavier work, will come into use as the old equipment wears out.

Some detailed cost figures kept at the Massachusetts Experiment Station show the following costs per ton of grass silage:

Fertilizer and manure.....	\$0. 82
Seed.....	. 12
Labor in preparing and seeding the land.....	1. 04
Labor in harvesting and filling the silo.....	2. 37
Molasses.....	. 78
Total cost per ton.....	5. 13

Any comparison of production costs for grass silage and corn must take into account the amount of feed nutrients per acre. Year in and year out, good corn land properly handled yields somewhat more silage than the same land in hay. However, not all land that is producing corn is good corn land. On such land the total yield of food nutrients may be less than the amount produced by a mixture of grasses and legumes. In most experimental results, corn outyields the other crops in production of total digestible nutrients per acre, but the yield of protein per acre is much higher in the case of the legumes, especially good alfalfa.

Nearly every dairy farm can increase its hay yields. Therefore, since protein is the most expensive part of the ration, and since the cost of planting and cultivating is considerably less with grass than with corn,



Filling a silo. (Photo courtesy of C. B. Bender, New Jersey Agricultural Experiment Station.)

it is clear that the use of grasses and legumes for silage compares quite favorably with the use of corn. There is one factor, however, that should be given consideration in making this comparison—the relative resistance to summer drought of corn and the second cutting of hay. Unless irrigation is available, summer drought is usually more serious to the hay and pasture crops than to the corn; thus, if a dairyman is depending entirely on grass silage he may be caught napping unless he carries reserves of feed over from one year to the next.

The Illinois Experiment Station has attempted to place a value on grass silage. Many farmers, and others, have tried to figure a value on the basis of production costs, but this is an elusive figure to obtain. The Illinois station has based its valuation of grass silage on the current market value of grain and hay. This represents the actual cost of replacing the silage with feed value equivalents. To compute the value on a ton basis, the value of 4.6 bushels of corn is added to the value of 270 pounds of mixed hay; this gives a value compensating for the seasonal fluctuation in the value of feeds and hay.

Most of the experiments on the feeding of grass silage have been concerned with dairy cattle. This is only natural in view of the returns especially if returns are through market milk from dairy cattle as compared with beef, horses, or poultry. Most of the evidence favoring grass silage over corn deals with such items as increasing the carotene content of milk, making for

better color, decreasing the amount of odors from oxidation, and maintaining a more uniform flow of milk the year around. Grass silage seems to have more importance in quantity and quality of milk than in the amount of flesh laid on animals.

On the other hand, at Cornell, dry, beef-breeding cows fed phosphoric acid silage were maintained quite satisfactorily, while tests run at the New Jersey Experiment Station showed the same results from feeding Sudan grass molasses silage. The animals came through the winter in good breeding condition and dropped strong calves. At the latter station the same results were experienced with breeding ewes, except that the ewes had to be fed a small amount of protein supplement just before lambing. Twelve horses were wintered over in satisfactory condition on molasses oat silage alone at the New Jersey station. Some of them were mares in foal. The men making the tests encountered less digestive troubles with the horses than at any time during the preceding 6 years.

Considerable interest has been shown during the last few years in the use of grass silage for poultry. Good grass silage is greatly relished by poultry and supplies the same important need in their winter diet as in that of other classes of livestock. Fifty-gallon buttermilk barrels make very good containers for putting up silage for poultry. The grass may be clipped with an ordinary lawn mower, put into the barrel, and firmly tamped down as the barrel is filled.

In filling a barrel of this size, about 4 gallons of molasses mixed in an equal amount of water should be added either while the barrel is being filled or after it is entirely filled. The barrel head should be put on as soon as the barrel is filled and weighted down so that there is a pressure of about 200 pounds on the ensilage. When the barrel is opened for feeding, the layer of mold which usually forms on the top should be scooped off before the silage is placed in the feeding pans.

Farm Building for Grass Silage.—More extensive use of grass silage naturally calls for a change in the design of barns and hay storage buildings. The large dairy barn has been a standard of prosperity for many years, and the more hay it could hold the better the barn. Yet silos can provide the necessary storage space at about the same cost per cubic foot as a conventional haymow, and each cubic foot stores over three times as much feed. When more farmers begin to store grass and hay in silos the need for the big hay barn will pass, and with it many of the dangers connected with fire and wind hazards. The annual barn loss from wind and fire is estimated at about 150 million dollars. Twenty percent of the loss suffered by farmers through barn fires is due to spontaneous combustion in stored hay. Good grass silage, because of its high water content, will not burn by spontaneous combustion.

Much trouble has come about through storing grass silage in an old corn silo. A silo that can withstand the pressure of grass silage must be considerably stronger than one built only for the storage of corn silage. It must also be tighter to prevent leakage of juices from the bottom portions, as leakage not only results in loss of food nutrients but contributes to sanitary problems as well. A silo full of grass silage as it is usually made weighs more than the same silo filled with corn and lateral pressure is therefore greater. If the older corn silo is used it becomes necessary to reinforce the lower third to prevent bulging.

Farmers using grass silage have had some difficulty from the action of the silage acids on the walls of their silos. If kept in good repair, a silo constructed of creosoted wood staves, galvanized sheet metal, clay tile, and other newer materials gives satisfactory service. The durability of a silo made from almost any material can be increased by a protective coating such as asphalt paint, cement wash, boiled linseed oil, and others. Silo manufacturers are alive to this problem; many experimental silos have been built in efforts to determine the best materials for walls and for cementing the parts together. Some of the materials are said to be resistant to all forms of acids de-

veloped by silage, and thus we may expect that this problem will pass out of the picture along with the difficulties now being experienced with old machinery.

Grass Silage and Soil Conservation Planning.—The farm planner is repeatedly faced with the problem of making a decision as to whether or not he should advise a soil conserving crop for land being used for soil depleting crops. The removal of crops from lands too steep to support them safely would be a big step in the direction of soil and moisture conservation. However, when a farmer has been accustomed to raising a certain acreage of corn each year and has built his dairy or livestock industry to match his crop, it is difficult for him to change his way of thinking. Such a change is no small part of the planner's job since he must work, without ceasing, toward getting some form of permanent vegetation on critically eroding fields and he must realize at the same time that such land-use changes must fit into the farming set-up.

By and large, grass is more permanent and more dependable year in and year out than are the cultivated crops. Weather is a difficult problem for all farmers, and any method of crop production that is somewhat independent of the vicissitudes of weather should be utilized to the utmost.

In this short summary of the data available on grass silage, I have not tried to tabulate all the advantages and disadvantages in the utilization of feed in this form. The main thing which a farm planner should remember is that sufficient experimental work has been done with the ensiling of green material to place the methods on a sound and economical basis. He should therefore avail himself of all the data locally available on the subject. A great number of farms needing a soil conservation plan are operated by farmers whose resources are extremely limited; usually, they do not have on hand the information available at their State experiment station. This small farmer almost always needs land adjustment more than the more well-to-do farmer who is in constant touch with the recommendations of his extension service representative. No farm is too small for its owner to pass up the possibilities of green silage for his livestock. He can preserve it in any type of container ranging from a good tight barrel or a trench silo to a \$2,000 upright silo.

INVESTMENT IN YOUTH

In August, G. H. Gilbertson tells of the CCC: "Today the Nation can look forward to receiving a big return from its investment in youth—and sturdy, able young men are perhaps the most important of her defense assets."

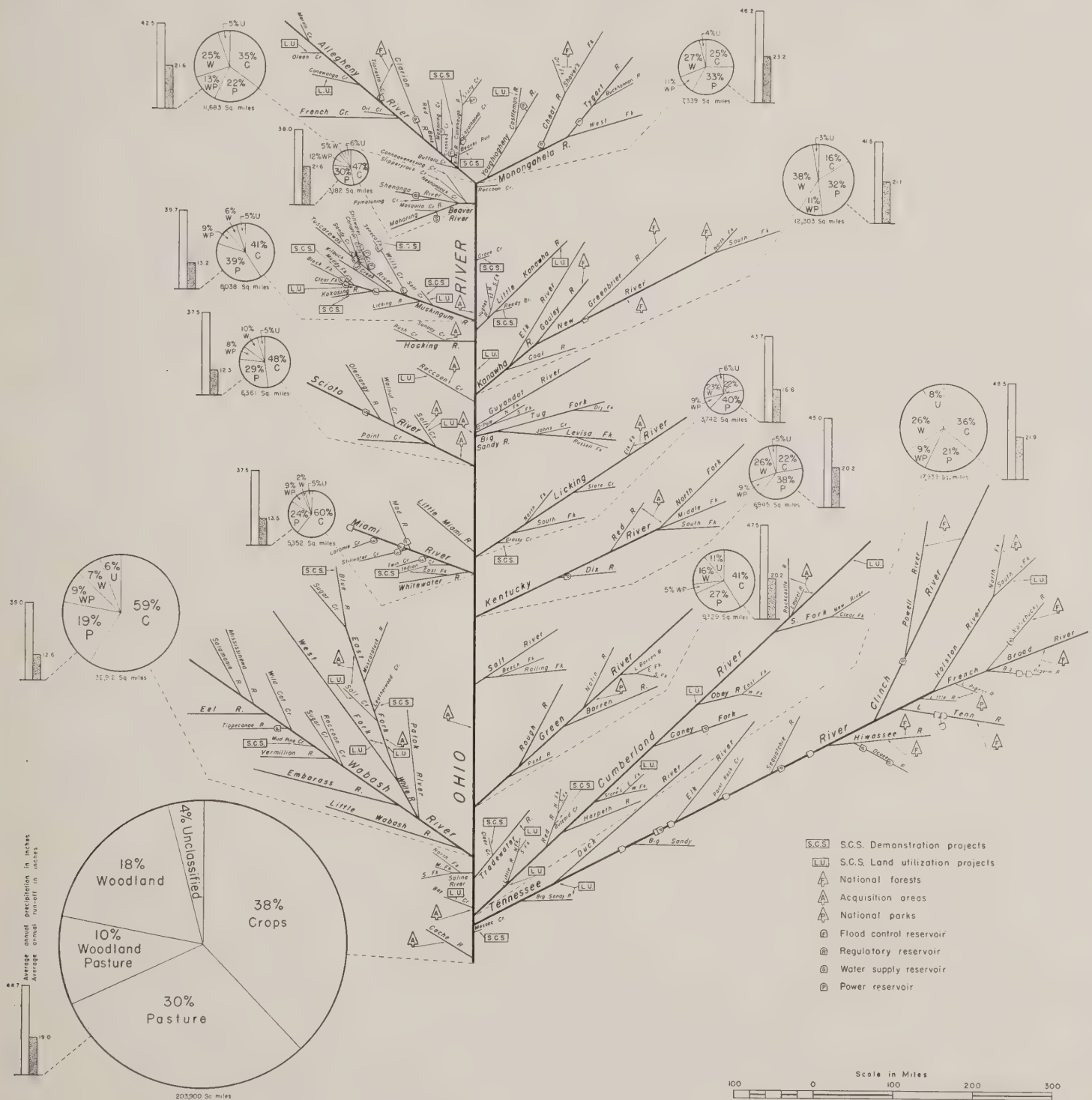
GRAPHIC PRESENTATION OF LAND USE AND HYDROLOGIC DATA

By C. S. JARVIS and H. C. MURTO¹

A VAST amount of basic data relating to land use and hydrology in the various regions of the United States has been collected and analyzed within

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the past 5 years by the Soil Conservation Service. Along with the work of collection and analysis we have recognized the need for a method of graphic presentation that will appeal to the user of the information and at the same time point out the items and



SCHEMATIC DRAWING OF THE OHIO RIVER SYSTEM SHOWING LENGTHS AND RELATIVE POSITIONS OF STREAMS, DRAINAGE AREAS, AND LAND USE; LOCATIONS OF GOVERNMENTAL CONSERVATION PROJECTS, MAJOR REGULATING RESERVOIRS; AND BASIC HYDROLOGIC DATA.

R-3097

the significance of their relationships in a manner to render them most convenient for reference. The schematic drawing and tree graph of the Ohio River system, shown in figures 1 and 2, illustrate some of the recent approaches to a solution of this problem. A brief discussion of these charts and how to use them is given in the following:

When information is wanted regarding the location and sequence of tributaries, their subdrainages from headwaters to junctions with the main stream, and locations of projects under various governmental and public utility agencies, then the schematic drawing, figure 1, is to be used. It shows also, in circular diagrams, the relative extent of drainage areas and the proportions of them in crop land, pasture, woodland pasture, woodland, and unclassified, for each of the major tributaries, as well as for the main river basin. For example, the percentages of cultivated land on the Miami, Wabash, and Kentucky Rivers are 60, 59, and 22 percent, respectively, while the corresponding percentages of pasture areas are 24, 19, and 38.

Associated with these circular diagrams showing land-use percentages are vertical bar diagrams showing respectively the average annual precipitation and run-off at corresponding stations, ordinarily about 40 inches per year for rainfall and from one-third to one-half this amount for depth of average annual run-off.

The tree graph is to be used when the desired information has to do with the relative slopes of stream channels, as well as the distance in miles above their junctions with the main river. In figure 2, the tree graph, it may be seen that the Tennessee River system extends more than 800 miles from its junction with the Ohio River and that it rises in elevation more than 300 feet within the navigable reach extending nearly 500 miles to Chattanooga. Similarly, the dams and navigation locks of other main tributaries are shown in their relative positions. The bar diagrams of hydrologic data show for each station not only the average annual precipitation and run-off depth in inches, as included in figure 1, but likewise corresponding depths for maximum monthly records. Furthermore, additional indices are supplied in the form of the fraction and quotient for each principal station wherein the numerator represents the maximum or flood yield in c. s. m. (cubic feet per second per square mile), while the denominator is the average for the period of record, shown as a subscript, and the quotient is the ratio of maximum to average yield. Thus, for Metropolis, Ill., Louisville, Ky., and Huntington, W. Va., the quotients are 7.2, 7.1, and 7.6, respectively, showing how consistently the

maximum flood yields of record have been approximately seven times the average discharge of the stream.

Among the tributaries the quotient is normally much greater; thus, for the Allegheny at Parkers Landing, Pa., it is 21.0, for the Wabash at Terre Haute, Ind., 19.9, and for Mount Carmel, Ill., 16.1.

Taken in conjunction with the data on slopes supplied in part by the profiles of tributary channels, shown much more in detail on topographic maps, and when considering the influence of land use and prevailing vegetal cover on run-off phenomena, the data on these drawings furnish valuable clues regarding flood magnitudes against which provision should be made.

Similar drawings have been prepared for the entire Mississippi River system in the course of assembling material for a U. S. Department of Agriculture bulletin to be entitled "Graphic Interpretation of Hydrologic Data as Related to Land Use." Naturally, much greater variation is shown within the Mississippi River basin than prevails in the Ohio basin where both the precipitation and run-off are more nearly equably distributed than for any other major tributary. Furthermore, the Ohio River yields nearly one-half of the lower Mississippi River discharge, from approximately one-sixth of the total drainage area; while the Missouri River yields more nearly one-tenth of the total discharge from nearly one-half of the total drainage area. However, among the headwaters in high mountainous regions, the Missouri and the Arkansas River tributaries have recorded yields more nearly approaching those of the Ohio Valley, expressed in c. s. m.; while the Great Plains areas show but meager unit-yields, both for maximum floods and for average discharge.

EQUIPMENT MAINTAINED

The following quotation is taken from the last semiannual report of the Bogue Chitto-Pearl River Soil Conservation District, Louisiana:

"The Police Juries of the parishes within the District are cooperating to the extent of furnishing funds for the maintenance of equipment loaned the district by the Soil Conservation Service."

Note: Parish police juries are comparable to County Commissioners in many other States.

CARTOGRAPHY AND DEFENSE

"The fastest system of making maps of good accuracy from aerial photographs" is described in an early issue of Soil Conservation by Harry T. Kelsh.

CONSERVATION PLANNING FOR SMALL FARMS

By T. J. CAULEY¹

IT IS becoming increasingly apparent that the Soil Conservation Service must develop a definite policy with respect to the problem presented by small farms in areas of relatively poor land. The problem consists in the fact that these small farms in many instances include a comparatively large percentage of land that must be retired from cultivation and planted to grass or trees in order to halt erosion effectively. The result of this dilemma, on the typical farm of this class, is that after such retirement the farmer has so little cultivable land left as to constitute what is usually referred to as an uneconomic unit.

The question immediately arises as to how small a farm unit must be in order to be classified as uneconomic. This question brings up the further question of how best to measure the size of a farm. The most common measurement, of course, is the number of acres it contains, but this is not always the most significant figure from the standpoint of the economy of its operation. From an economic standpoint the size of a farm should be measured in terms of its net income, although, naturally, the number of acres is one factor that influences the amount of net income. On the other hand, it is by no means the only factor to be considered.

Granting that the size of farms should be measured in terms of net income, how small can this income be without becoming "uneconomic"? Obviously, no final, definite, universally applicable answer to this question can be found. To put it concretely, can a farmer afford to continue to operate a farm which yields him a net income of only \$400 a year? The answer depends largely on the alternatives open to him; and since such alternatives will vary widely with individual farmers and in different localities, the answer will vary accordingly.

As the problem exists in parts of Arkansas, Louisiana, Oklahoma, and Texas, large numbers of farmers are operating small farms with virtually no other economic opportunities available to them unless they are given help of some sort. Their net farm incomes, including both cash and subsistence, probably will not average more than \$400 a year. What are we to do about them in the way of conservation of soil resources?

If Soil Conservation Service personnel plan a small farm for conservation purposes in such a way as to yield the farmer and his family less than enough for mere biological existence and the essential social services, the farmer will either refuse to sign an agreement including such a plan or sign it and within a short time be forced by economic pressure to violate it and resort to exploitative methods. In either case, the soil conservation program will have failed in its essential objective of saving the land for the peoples' sake.

Several possible approaches to this problem are open. Let us list them, and then examine each of them briefly by way of determining its merits and workability.

1. A farmer whose farm is too small may either buy or rent additional land in the neighborhood if it is available.
2. If additional land is not available, a sufficiently large number of farmers may be moved out of the locality to enable those who remain to have farms of adequate size.
3. A program of part-time farming and part-time nonfarm employment may be developed in the locality.
4. A more intensive type of farming may be developed on the adapted cropland, pastureland, and woodland which the farmer has and thus enable him to obtain an adequate income.

The possibility of the small farmer buying or renting enough land in his immediate vicinity to give him a unit of adequate size is strictly limited. Areas needing adjustments of this kind usually are areas of serious rural overpopulation. No surplus of land is available. What is bought or rented by one farmer in the effort to obtain an economically sized unit frequently is taken away from some other unit that needs it just as badly. No net gain is achieved in shifting land from one small operating unit to another. Obviously, however, in those comparatively rare instances where unoccupied land is available nearby, the purchase or lease of this land by the farmer is the simplest and best solution of his difficulty. The Farm Security Administration and the Farm Credit Administration can help in these instances.

The general method of moving enough farm families out of a locality to enable those left to have

¹ Chief, division of economic surveys, Western Gulf Region, Soil Conservation Service, Fort Worth, Tex.

farms of adequate size has been tried to a greater or lesser degree by the Resettlement Administration and its successors, one of which is the Land Utilization subprogram of the Soil Conservation Service as financed by "title III" funds. Undoubtedly, the method has potentialities and already has accomplished some good. For the present and the immediate future, however, the funds available for this type of adjustment are so limited in proportion to the need that the method is practically negligible in importance from the standpoint of meeting the problem adequately.

More fundamental perhaps than the lack of funds is the relative lack of any place to locate the farm families that are moved. No agricultural areas of appreciable size which are underpopulated from the standpoint of the farmers' ability to make money are at present available in the United States. On the contrary, the ability of American farmers, both collectively and individually, to make money would be greatly increased by a large net reduction in the number of farmers throughout the country. No good farming section in the Nation would welcome an influx of farmers from poor-land areas.

With respect to the possibility of shifting these people into urban occupations, it is clear that so long as we have millions of unemployed persons in our towns and cities this line of attack offers no real promise.

The third method listed above, that of providing part-time nonfarm employment to supplement the income from small farms, likewise has been tried by the Resettlement Administration and some other agencies. Thus far, it has had indifferent success. The decentralization of industry in the United States has been widely prophesied, but it is still a prediction rather than a fact.

One significant possibility of developing rural non-farm work can be seen in many parts of Arkansas, Louisiana, and eastern Oklahoma and Texas, in the opportunity of combining farming and forestry to advantage. The forestry may be commercial in nature, it may be for the production of forest products for home use, or it may be a combination of the two.

A further possibility is the development by the Federal Government of a "rural works program" which would provide employment in conservation work for unemployed and underemployed rural people. Such a program would go a long way toward immediate relief of rural distress and at the same time help to conserve the basic resources of our agriculture, thereby removing one of the fundamental causes of rural distress.

We come now to the fourth possibility—more intensive utilization of what cropland the farmer has left after the application of the conservation plan to his farm, along with as intensive a use of pastureland and woodland as is consistent with conservation requirements. In almost all of the small farm areas in the Western Gulf Region, which includes all of Arkansas and Louisiana and most of Texas and Oklahoma, the prevailing type of farming has been cotton and corn. When the acreage of these crops is reduced, the farmer does not have the opportunity of making productive use of enough of his labor throughout the year to obtain an adequate farm income. It is possible that this difficulty may be offset by the production of more intensive crops and the development of more intensive livestock enterprises.

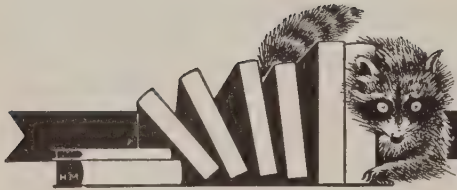
Some possibilities for diversified farming and supplementary income in such areas are listed in the following: the growing of truck crops; production of blackberries, grapes, and other small fruits; commercial orcharding, especially peach growing in parts of Arkansas and Texas; poultry production, dairying; intensive woodland management, yielding commercial forest products; the production of food, feed, and fuel for subsistence purposes. Obviously, not all of these are adapted to any one locality.

The chief difficulties involved in the intensive and diversified pattern of farming as against traditional cotton and corn farming are to be found in the inertia of the farmers, their lack of knowledge and skill with respect to the new enterprises, and the greater complexity of marketing the products of such a type of agriculture. These are very real difficulties and cannot be passed over lightly.

Furthermore, the general adoption of this pattern of farming would bring up the serious problem of the effect of increased production of such products upon the national and even the international supply and demand situation. As a nation, we are committed to a policy of restricting agricultural production to fit the effective demand therefor. Any shifting of land uses for conservation purposes should be harmonized with this broad objective.

When the lack of a proper pattern of land use and balance of enterprises stands in the way of application and maintenance of an adequate conservation program on a farm, it immediately becomes the function of the Soil Conservation Service to work out a satisfactory pattern of land use and balance of enterprises. The personnel of the Service should inform the farmer as to how much and what parts of his land can be safely

(Continued on p. 28)



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

AGRICULTURAL LAND-USE PLANNING IN THE TERRITORY OF HAWAII.

By John Wesley Coulter. Agricultural Extension Service, University of Hawaii, Honolulu, 1940.

To the land-use planner, Hawaii is not merely the land of soft music and tropical radiance; it is a series of small areas, totaling considerably more than four million acres, separated by waters of the Pacific, with extremely diverse relief and climate, a growing and changing population and needs very similar to those on the mainland in spite of the isolation of the group. Dr. Coulter's intimate and sympathetic account of the people of the islands, their homes and work, their ambitions and opportunity, and their loyalties and pride in the development of their economic and industrial life, is one of the most illuminating to be found anywhere. A chart showing racial population of the islands throughout the 1853-1939 period indicates assimilation to the point of homogeneity within the not distant future, and this trend may prove to be extremely important in the development of land use in all the islands.

Geologists go, or want to go, to Hawaii to see the parent rock of the far distant future in the making; the land of the islands is relatively youthful, and drastic rapid changes in formation and physical composition are common occurrences. But, more practical

and of much interest to conservationists, is the fact that recent detailed surveys of some of Hawaii's pineapple fields, pastures, and vegetable and fruit lands indicate that there is beyond a doubt a present-day erosion and land-use problem of considerable importance in the Mid-Pacific island group.

Dr. Coulter gives an excellent analysis of the agricultural industries of the islands, not only types, areas and planning involved, but field methods and labor conditions as well. Sugarcane is of course the major crop, and 30 percent of the people of Hawaii live on sugar plantations, while many others depend upon this highly specialized business for livelihood. Pineapple production comes next in importance, and it is interesting to note that growers are beginning to use soil conservation methods that will protect and improve the land and at the same time permit use of some areas for a more diversified farming.

In a final section, Dr. Coulter discusses at length the chances for diversified farming in these Pacific Islands and points out the several conditions now standing in the way of the small farmers who would like to own land and practice agriculture as a way of life rather than as a commercial enterprise. The need for soil conservation education is emphasized, also for land tenure studies and a regional approach to the land-use planning problem. It is of very great importance, in the author's opinion, that land-use planning for the Territory of Hawaii should include ways and means of providing food supplies commensurate with the use of the islands for strategic purposes.

DISTRICT PLANS BY WATERSHEDS

(Continued from p. 18)

and farm plans then are developed to fit the watershed as well as the farm.

Drainage plans supplied by the district must take into consideration such problems as the outlet for tile systems, bank protection, and slopes suitable for proper maintenance. Actual drainage work is being done by contract between the local drainage association and contractor, with provisions for inspection and supervision by the district.

Conservationist Binnie believes that initial success of the Knox watershed plan can be attributed to close cooperation of all local agencies including the district supervisors, the Extension Service, Triple-A, the CCC-camp administrators, the Farm Security Administration, and the Soil Conservation Service. Supervisors of the district are John Wolfe, chairman, Ivol Myers, N. Y. Yates, Lester Williams, and Charles Stevens. Stevens probably reflects the opinion of the group in this remark: "The trouble with us is that we got started 20 years too late. As an advisor to the F. S. A. I get to see a good many farms in all parts of the county and I believe that most farmers do not realize the damage already done by erosion."

CONSERVATION FOR SMALL FARMS

(Continued from p. 27)

utilized for various purposes, indicate the balance of enterprises called for, and help him to obtain the necessary assistance from the proper persons or agencies to enable him to utilize this available land to give him a farm income as nearly adequate as possible.

In the final analysis, however, our farm planners cannot hope to make satisfactory farm plans unless they obtain sufficient information concerning the economic aspects of the farms they are planning to enable them to forecast the economic consequences of the conservation plans they propose to apply to the farms. In order to make a sound forecast of the economic consequences of a farm plan, the planner must know the present sources and amount of the farmer's income and also the amount of his expenses. He must then judge to the best of his ability the probable effects his proposed farm plan will have on income and expenses. If the result of his weighing of the facts is seriously unfavorable, the planner must cast about for means of remedying conditions on the farm without sacrificing the basic objective of conserving the soil.

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



Field offices should submit requests on Form SCS-37, in accordance with the instructions on the reverse side of the form. Others should address the office of issue.

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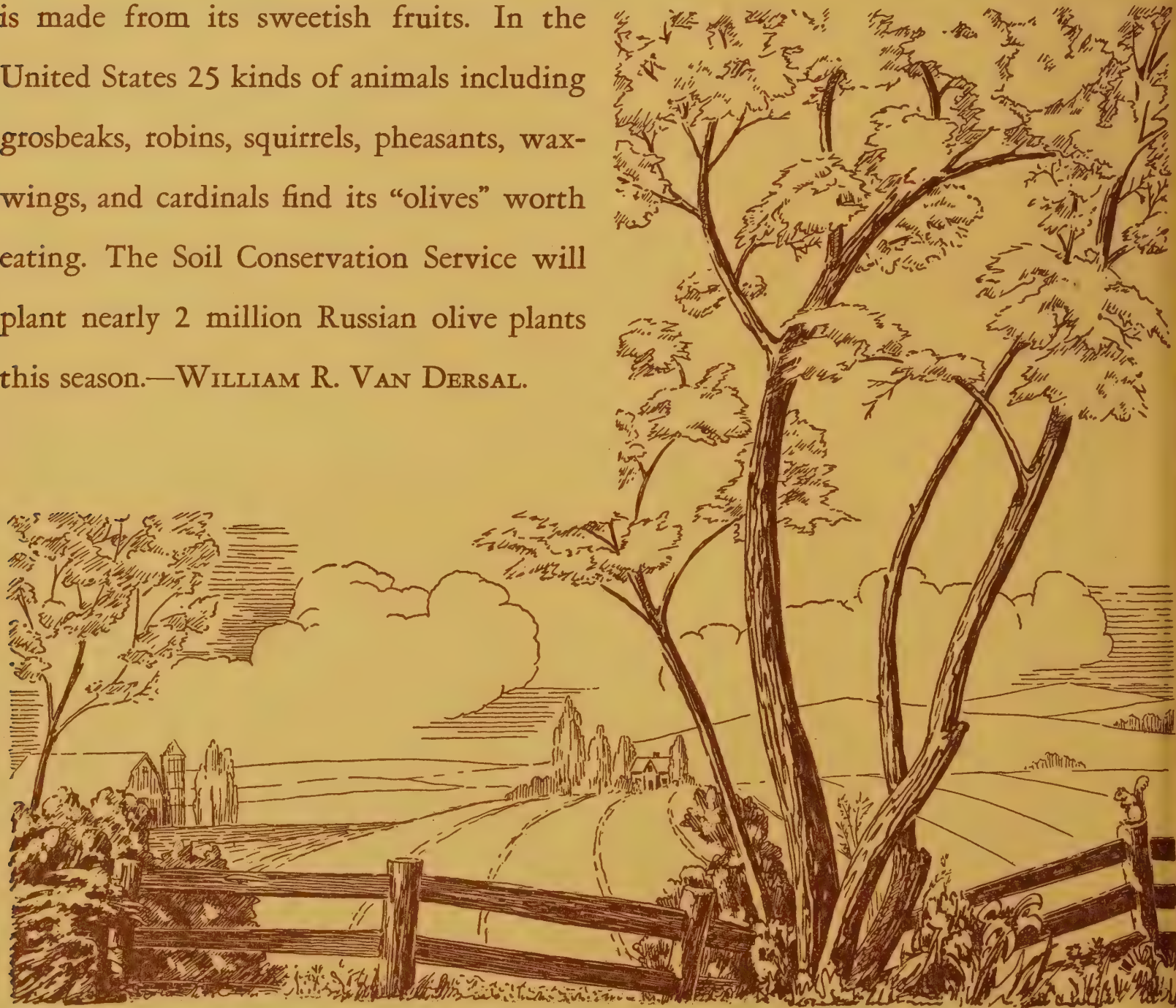
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¹ From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



RUSSIAN OLIVE—neither an olive nor exclusively Russian, but *Elaeagnus angustifolia* from southern Europe and western Asia—has turned out to be a plant of considerable worth for soil conservation planting, particularly in the western half of the United States. First introduced in 1897, it has since gone wild in several Western States where it has proved itself able to withstand extreme drought, cold, and considerable concentration of alkali.

For several centuries this shrub or small tree has been used in Europe for ornamental planting, a purpose it serves well in this country also. In the Orient a kind of sherbet is made from its sweetish fruits. In the United States 25 kinds of animals including grosbeaks, robins, squirrels, pheasants, waxwings, and cardinals find its “olives” worth eating. The Soil Conservation Service will plant nearly 2 million Russian olive plants this season.—WILLIAM R. VAN DERSAL.





AUGUST 1941

Defense!

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SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

A stirring call to confidence in democracy—a bristling challenge to the farmers of America to complete the high task they have begun so well—is Dr. Bennett's inspiring article, "Look At America."

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

	Page
"Look At America"—A Great Democracy Does Things!	
By Hugh Hammond Bennett.....	29
Conservation Against a Horizon of War:	
By F. E. Charles.....	31
Land for Defense Needs:	
By James M. Gray.....	34
Rehearsal for Defense:	
By G. H. Gilbertson.....	37
Fitting Land Utilization to National Defense:	
By William R. Noble.....	40
"A Triumph of Common Sense".....	42
Cartographic Division and National Defense:	
By Harry T. Kelsh.....	44
The Perplexing Case of Indian Corn:	
By William R. Van Dersal.....	46
Building a Sod Defense:	
By C. R. Enlow.....	52
This County Supports Its District:	
By Harry B. Carroll and Frank B. Harper.....	54
Down in Puerto Rico.....	58
Book Reviews and Abstracts:	
By Phoebe O'Neill Faris.....	59
Excerpts from Recent Addresses by Secretary Wickard.....	Inside back cover
Front and Back Covers: C. E. Margraff and Katharine R. Johnson	

WELLINGTON BRINK
EDITOR

SOIL CONSERVATION is issued monthly by SOIL CONSERVATION SERVICE of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business, with the approval of the Director of the Budget. SOIL CONSERVATION seeks to supply to workers of the Department of Agriculture engaged in soil conservation activities, information of special help to them in the performance of their duties. Copies may also be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., 10 cents a copy, or by subscription at the rate of \$1.00 per year, domestic; \$1.50 per year, foreign. Postage stamps will not be accepted in payment.

"Look At America"—A Great Democracy Does Things!

By Hugh Hammond Bennett, Chief, Soil Conservation Service

The most important thing in the lives of Americans today is the great world conflict now raging on three continents. The peril it holds for us is clear. We are in very real danger. When the armies of the Axis marched a few weeks ago into the biggest country of them all it was another in a long series of moves and counter-moves that have increased the peril to America day by day.

We are working with all our energies now, to make this nation stronger and stronger—internally and in military might. That is our first concern. But because we are hastening to make ourselves invincible, it does not follow that this democracy of ours is weak. Quite to the contrary, we are very strong. It is almost amusing to hear dictators shout "Democracy can't match our efficiency," and "Democracy is decadent." To that kind of talk we have an unbeatable answer: "*Look at America!*"

Look at America, and see what democracy has done. Look at Grand Coulee Dam, the biggest masonry structure ever built by man. Behind its great wall, 553 feet high, will be stored *three trillion* gallons of water. The electricity generated there will furnish light and power to thousands of homes; the waters backed up will spread through a vast irrigation system, bringing life and productivity to hundreds of thousands of acres of land, opportunity and security to thousands of our people. Yet you might say we just tossed off Grand Coulee in our spare time. We paid good prices for all the materials we used. We didn't force men to work there. We paid them the highest wages in the world, and we worked them short hours. How's that for an out-of-date, tottering old democracy?

We hung a bridge almost a mile long across San Francisco Bay. We built over 400,000 miles of paved highways, connecting every city, village, and hamlet in the country. We have almost half the world's telephones, five times as many as any other country on earth. We have more refrigerators, washing machines, automobiles, farm equipment, radios, bathtubs, and schools than any country anywhere. We have built skyscrapers 1,250 feet high. We dug the Panama Canal. Is there anything we haven't done?

Any *one* of these things would be a major accomplishment for the dictators. They would advertise it to the world and boast about it to their people. We take such things in stride. We are used to it. We do something like that every day. Tomorrow we will do more, and next year more than that. No, we are not at the doddering stage yet.

Recently I read in one of the magazines about a European King, now exiled from his Nazi-conquered country, who told an American newspaper correspondent how 14 young men were selected to be trained for government jobs in his country. Seven of them were sent to England to study and the other seven to the United States. The King told the reporter that the seven who went to England were very smart and were now holding down important government positions.

The news writer asked, "What about those who went to America?"

"They were even smarter," said the King. "They stayed there."

We have our faults to be sure; our society isn't perfect; there are a lot of problems to be solved; but we are the envy of every other people in the world. With all our shortcomings, we are the richest, the strongest, and the most fortunate people on earth. And that proves one thing above all others: It proves that whatever their defects, our government, our economic system, and our society are still the best that man has devised in 5,000 years of experimenting.

A few years ago, the Government of the United States made a survey of soil erosion throughout the country. It was the first time it had ever been done, and it disclosed an amazing situation. In less than two hundred years, America had lost one-third of its topsoil. At the time of the Revolutionary War, our topsoil averaged about nine inches in depth. In 1935, when the survey was made, the nine inches had shrunk to about six. One-third of our good soil was gone!

About 50 million acres of cropland had been so ruined by erosion that it could no longer be cultivated. That is as much cultivated land as there was in France before the present war—*more* than there was in Italy, or Germany, or Spain. Erosion had severely damaged over 230 million acres more of crop and grazing land. Most of the damage had taken place in the last two or three generations. Fields our grandfathers had planted were washed away. Where they had raised corn and wheat, we had gullies and ravines.

Now this was a matter that vitally affected not only the individual farmer here and there but the *entire nation*. Erosion was dealing body blows to our whole agricultural industry; indeed, to our whole national structure.

Here was a challenge to democratic government. There were people then who said we couldn't handle a problem like that by democratic means. Some said the government would have to force farmers to conserve their soil. Others said we couldn't stop erosion because every man had a right to use his land as he pleased, and if we interfered with that right, we would be killing democracy.

Most of us put no stock in that kind of talk. We knew a free people would meet this challenge as it has met others. So we pointed out to the farmers and ranchers of America the need for conservation of the soil, and showed them how they could stop their farms from going out from under them. We offered them the help they needed and asked them to do the job themselves. We didn't promise any rich rewards or threaten any punishment. We relied upon the sense of responsibility, the patriotism, and the ability of American farmers to do the job themselves, in their own way.

Well, in less than 5 years the farmers of America have gone into their polling places and voted to establish more than 530 soil-conservation districts. These self-governing bodies now embrace over 325 million acres of farm and ranch land. The farmers in these districts have given up none of their fundamental rights. On the contrary, they are *using* those rights to elect officers, vote on the adoption of programs, and conduct all the business of the soil con-



SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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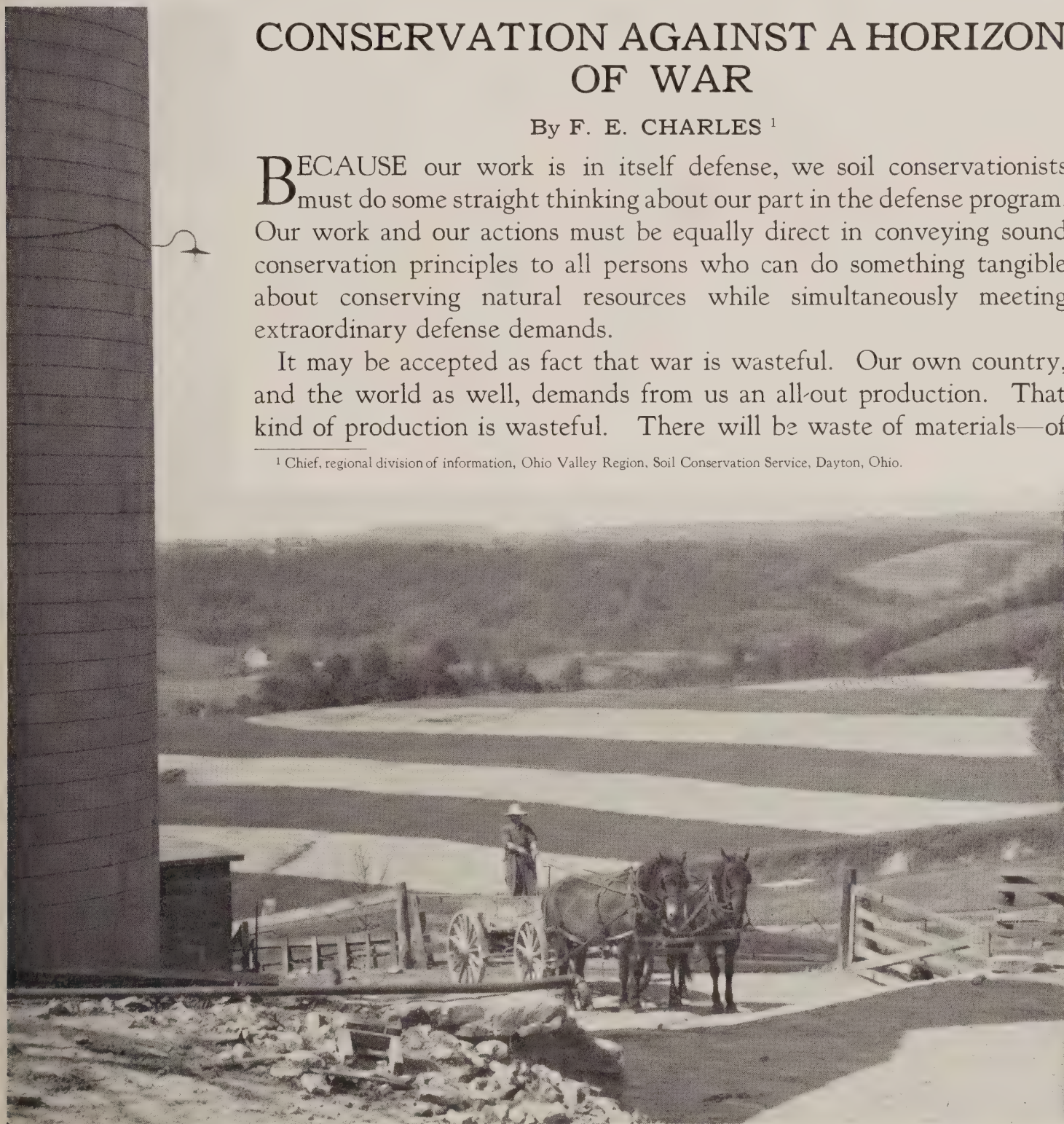
CONSERVATION AGAINST A HORIZON OF WAR

By F. E. CHARLES ¹

BECAUSE our work is in itself defense, we soil conservationists must do some straight thinking about our part in the defense program. Our work and our actions must be equally direct in conveying sound conservation principles to all persons who can do something tangible about conserving natural resources while simultaneously meeting extraordinary defense demands.

It may be accepted as fact that war is wasteful. Our own country, and the world as well, demands from us an all-out production. That kind of production is wasteful. There will be waste of materials—of

¹ Chief, regional division of information, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.



planes, of gun-powder, the ships we build; waste of labor, food cargoes, fuel oil, hospital supplies—countless items that have their origin in America's soil and water.

We feel sure that we can afford this waste to win the war and save democracy for ourselves and those other peoples who wish to avail themselves of democratic ways. There are, however, many conservation aspects of total defense. Will not the Nation look to conservation agencies for leadership in "conserving while wasting"—for a cause that is morally right?

It is significant that Canada, a nation at war, recently held, through the Canadian Conservation Association, its first annual national meeting for conservation.

"Conservation," said one of the principal speakers, "means wise use, not withdrawal from use. The attitude of the true conservationist is not that of a miser. Rather, it is an attitude that requires the application of imagination, skill, and courage to the management of our renewable natural resources, to the end that this generation may enjoy their benefits yet hand them on unimpaired to those who will come after us."

It was a forester, J. D. B. Harrison of the Dominion Forest Service, who pronounced that interpretation and found it acceptable to Canadian conservationists.

Along with us, our neighbors to the north believe they can use their natural resources and at the same time retain them. For example, they desperately need foreign exchange so that they may buy war materials of many kinds from other countries. The chief source of that foreign exchange in 1940 was forest products.

"Trade in all commodities other than wood, wood products, and paper, together with net exports of nonmonetary gold, yielded a favorable balance of 4 million dollars," Harrison explained. "But trade in the products of the forests and forest industries yielded a favorable balance of 310 million dollars."

This Canadian forester detailed the wasteful methods that have been, and in many ways still are, in use. "The present state of large tracts of Canadian forest lands is one of transition from an unmanaged to a managed condition," he concluded. "Problems remain . . . research is needed . . . before we can reach the goal of sustained yield . . . But progress is being made, and the future is not lacking in promise."

Our Canadian friend is giving us a splendid example of maximum use while maintaining the basic resource. Canadians know they can harvest timber crops and yet maintain forest cover. With proper fire control, the remaining forest cover also holds soil moisture, helps regulate stream flow which in turn facilitates operation of great hydroelectric plants.

What is the corollary to this in the United States? In many places, Indiana and Ohio for example, there is grave concern over lowering water tables. Better maintenance of farm woodlots, with annual harvests, would help to raise water tables. Thick pasture turf and luxuriant meadows, for grazing and hay crops, would produce more butter, pork, beef, and still hold more water and thus help to raise water tables and flow-levels in streams from which come industrial water supplies.

Contour cultivation will hold more water, grow larger yields on fewer acres, permit storage of reserve foods in other acres—and still guarantee adequate available foods. In the last war we plowed more and wasted much. Now, we will plow less, yet grow more.

CCC camps have provided one of our real assets in the fight to minimize soil waste. The camps also built strong bodies and developed minds. Thousands of CCC enrollees still work at soil and water conservation, while former enrollees have moved on to jobs in defense industries—another example of "using while conserving" for future needs.

These are conservation aspects of defense. Use and conserve.

The whole conservation program of the United States Department of Agriculture, numerous other Federal bureaus, State conservation departments, Friends of the Land, and so on, is one of defense. It has always been defense—defense against waste—conservation through frugal use.

We can go all-out for defense without being prodigal on the land. We can build factories and ships of wood and steel while on the land we maintain protective cover. We can send butter and lard and tomato juice to Britain—if we will hold the water and the soil; if we will add fertilizers, and use barnyard manures, and plow green-manure crops into the soil, and then take steps to retain unused portions of these fertilizing elements in the soil instead of allowing them to wash away; if farmers will remember that leaching and soil erosion remove many times as much of the plant nutrients from the soil as is removed through cropping and grazing, and if they will hold those unused nutrients in the soil.

The United States and Canada and all the other Americas can produce in abundance without impairing the supply of basic resources if they will avoid unnecessary waste. Democracies can defend themselves and be stronger afterward. We can arm ourselves by using the store of reserves we have kept in the soil. After this emergency we can begin hoarding again, in thrifty but not miserly fashion. Nearly a

quarter of a century passed after the last war before we realized that we were continuing the prodigality begun in the great conflict.

Referring again to the Canadians' conservation meeting, we find in the main address, by Dr. H. H. Bennett, still other conservation aspects for our defense program.

"Our efforts to conserve the soils and waters of America have produced two great and important contributions which will prove to be of immeasurable value to us now that the world is locked in war," the Chief of our Service declared.

"The first is the strengthening of democratic government and the faith of our people in that form of government through our success in meeting this test of our ability to govern ourselves. Once again we have solved our problems with the petition and ballot where others might have resorted to fire and the sword."

Farmer-organized soil conservation districts and AAA referenda on production control are good examples of "petition and ballot."

"The second contribution," Dr. Bennett continued, "is that our labors have made America more than ever worth defending. Our soils will be safe, our rivers and our forests will be safe regardless of the demands that war and reconstruction may put upon them. Never again, when circumstances force us suddenly to increase production of agricultural commodities, will we haphazardly and recklessly plow up plains country that will blow away, plow steep slopes that will wash away, or cut forests in such manner that generations cannot replace them."

It is important not to let the turbulence of war dim our perspective. Right now, winning the war for democracy is the Nation's first aim. Let there be no confusion on this point. We must defend ourselves at any cost. That we can and will do. And we will look beyond the ugly horizons of war. We are conservationists who, for near a decade now, have worked with the zeal of evangelists, fighting fire and planning, the while, how to replace the burning structure. Here again the Chief of the Soil Conservation Service has cut the cloth for us:

"We must think beyond the conflict, too, of the ways and the wherewithal of progress. Then, as perhaps never before, we shall need to call upon our resources—and they must not have been spent. We have not always been so wise. In the chaos of the first World War, we robbed ourselves hysterically and needlessly. In the Great Plains of the United States alone, some 30,000,000 acres were damaged or ruined

by wasteful use—a lesson we shall be wiser to remember than repeat.

"What profits it to spend enormous sums of money, to use up countless tons of irreplaceable resources, to sacrifice the lives of thousands of men, in defense of a Nation—if we let that Nation waste away?

"If it is worth an army to fight off an enemy that threatens our people with shells and torpedoes and bombs—that threatens our civilization—is it not worth a determined effort to combat the enemies that threaten our fields, our forests, our grasslands from which come our strength and security?"

The professional conservationist—and all who are conservationists at heart—will see that each conservation aspect of national defense means work for us. Let us not deceive ourselves—the job will be harder because of our total war effort; but if defense is urgent now, husbanding soil and water and forests is vital to our future.

We must work harder than ever before to make our people understand that America cannot well afford further destruction of the goodness of its earth. As an evangelist, or an educator, a farm planner for soil conservation, an extension specialist, or whatever you prefer to call yourself, you can contribute to total national defense by believing and preaching conservation.

If you can reach and influence one person to save a little soil, a farm pond, or a useful bird or a tree, our total resources will be swelled by that much. Conservation, like other ideas and philosophies, is contagious. Soil conservation districts, for example, are like rolling snowballs, they grow bigger, cover more ground. The teaching of conservation in schools will bring results not even imagined as yet.

We must keep these things in mind and remember that the conservationist's defense job is rather well cut out for him. It would be a disaster if, in winning the war for democracy, this continent should lose all that it has gained, and more, in its battle for conservation. It would be a world tragedy if, in defending its borders, North America should lose the very resources—its soils and its waters—that make it strong.

Grass

We have as much reason for discriminating against corn-fed beef as we have for discriminating against grass-fed beef of the same degree of fatness or finish. Three years' tests of the carcasses of 60 steers fattened on bluegrass pasture and 60 steers fattened to the same degree on corn, cottonseed meal, and hay, showed that the grass-fed beef was as juicy and nutritious, and tasted just as good as the beef from the corn-fed steers. In fact, the judges could not tell the difference when they were eating the beef from the two different rations.—A. T. Semple.

LAND FOR DEFENSE NEEDS

By JAMES M. GRAY ¹

SINCE last September the Land Acquisition Division of the Service has mapped, appraised and optioned or prepared condemnation actions on approximately 345,300 acres of land for the War Department in connection with the National Defense Program.

This land will cost approximately \$8,520,200. Additional land to the extent of 634,600 acres, costing \$13,951,200 is to be acquired on these 27 projects. Personnel are now being organized to map, appraise, and secure abstracts of title on more than 1,500,000 acres of land for later purchase. This volume of work probably will continue for at least another year.

This contribution to the program of the War Department was made possible by former Secretary of Agriculture Wallace in response to a request from Secretary of War Stimson that the services of the Land Acquisition Division of the Soil Conservation Service be made available to him on a reimbursable basis.

The acquisition procedure established for acquiring land under title III of the Bankhead-Jones Farm Tenant Act is followed very closely, including the preparation of abstracts of title, perfecting title, and final closing and payment. The principal difference is the organization procedure. In our regular work, authority and supervision run from the Washington office through the regional office to the project. In our work for the War Department authority and supervision run directly from the Washington office to the project. This is because of the need to follow closely the procedures of the War Department and the more expeditious processing of the program.

At present operations are being carried out on 27 locations in 16 States. Four hundred and forty workers are employed exclusively in the program. This includes classifications from laborers to land appraisers.

A typical project organization is as follows: A project manager in general charge; a reviewing appraiser in charge of the work of other appraisers and negotiators; a cadastral engineer in charge of personnel doing surveys and mapping; a curative specialist in charge of title work and closings; and an administrative clerk in charge of the group doing the necessary clerical work.

Most recommendations on personnel actions, and vouchers for payrolls and expense, move directly to the Washington office of the Land Acquisition Division

for approval for payment. The exceptions are those that are concerned with personnel detailed by the regional office to this work. The remarkably expeditious processing of these matters could not have been accomplished without the efficient and sympathetic cooperation of the Budget and Finance Division, the Personnel Management Division, and the Service Operations Division of the Service.

The authorization from the War Department to perform these services on a particular project carries with it a brief statement concerning the number of acres to be acquired and the amount of money available, and a map giving the approximate boundaries of the area. With this meager information the work of acquiring the land is initiated.

The first step, after establishing an office and securing the personnel, is to search the records as to ownerships in the area and prepare a description of the individual tracts as a guide in mapping, appraising, abstracting title, and optioning. Then the project rapidly takes shape and outside boundaries are established. This necessitates a tremendous amount of detailed work of clerks, engineers, draftsmen, and other technical personnel. Yet, with all this large volume of careful, detailed work and the tedious steps necessary in employing personnel, surprisingly rapid progress has been made. Since October 1, 1940, the average weekly encumbrance of land purchase money has been considerably more than \$200,000.

A land acquisition program for purposes of national defense cannot be an entirely voluntary one. No matter how well trained and efficient are the appraisers, whose judgment forms the basis of negotiations for land, differences will arise with the owners as to prices to be paid. The appraisers being used are men trained and experienced in land appraisal in the general localities of the projects. They are well aware of the extraordinary conditions under which these purchases are made and are sympathetic toward the owners. They are also conscious of their sworn duty to perform honestly the trust placed in them through the Federal Government by the 130,000,000 citizens and taxpayers of the Nation.

If the owner and our negotiator agree on a price consistent with the appraisal value, an option to sell is secured and forwarded to Washington for acceptance by the Real Estate Branch of the War Department. This gives the War Department the right of

¹ Chief, land acquisition division, Soil Conservation Service, Washington, D. C.



possession at any time after the acceptance of the option. The War Department is most sympathetic and considerate in exercising this privilege by avoiding as much loss and inconvenience to the owner as is possible and consistent with the emergency needs for the property.

In instances where it is found impossible to arrive at an agreed price, supported by an option to sell, it becomes necessary to ask the Federal court to determine a fair value. The first step in this action is that those in charge of the project prepare a statement of ownership supported by an abstract of title and recommend court action to secure control of the land based on the appraisal price. This is forwarded to the Real Estate Branch of the Quartermaster General's Office of the War Department. A request is prepared by the Quartermaster General's Office to the Attorney General to institute condemnation action with a Declaration of Taking. Acting on this the Federal court is asked to determine ownership and to fix a fair price. The court appoints a commission of taxpayers to review the property and to fix a price. If this price is not satisfactory to either the owner or the Government, an appeal can be made for a jury trial. In the meantime, however, because of the Declaration of Taking attached to the condemnation action, the court can give the Federal Government possession of the land and the War Department can proceed with its use.

Members of the Soil Conservation Service, as well as other citizens, can be very helpful in this program, fraught with great economic and social disturbance factors, by making every effort to inform the public of the method of acquiring land for national defense purposes and to assure the people that the War Department desires to be as liberal as to prices, and as



A community makes its contribution to National Defense. Material ties, spiritual associations and home attachments are set aside in Caroline County, Va., as urgent needs arise for the army. Visual evidence of sacrifices entailed in the acquisition of lands for defense purposes is seen on this page—a church, a house, and a cooperative sweet potato association plant, all among properties now included in the A. P. Hill Military Reservation.

considerate in exercising possessory rights, as it is possible to be in conformity with laws and sound government business.

The lands being acquired will be used for various purposes, such as extension of present reservations, new training camps, maneuver grounds, air fields, antiaircraft training and firing centers, artillery and air bombing ranges, munition plant sites, and storage depots.

Just west of Savannah, Ga., 360,000 acres of land are being bought for Camp Stewart, an antiaircraft firing and training center. When this camp is completed there will be accommodations for 17,000 troops and a firing range of 17 miles radius on a 180-degree horizontal angle. It will be necessary to move from this area 1,500 to 2,000 families. Four consolidated white schools, 20 white churches, 10 negro schools, and 10 negro churches also must be removed. Several small villages will be completely removed as well as a considerable number of small community centers. Roads, telephone lines, and electric power lines will be discontinued.

This disturbance of peoples' lives, of civil governments and public institutions is the same at all locations. Its extent depends largely on the density of population and the development of public services and institutions. Not all disturbances are harmful. One owner of a telephone system, serving a small town and rural community, made a loud complaint because of loss of rural subscribers. When asked to make a financial statement of his losses he had to show that the increase in subscribers in the town, due to the Government establishing a permanent camp there, was three or more for every rural one lost.

The smallest area acquired thus far is 10 acres to be used as a site for a beacon light. The largest is a bombing range of 1,250,000 acres, just assigned to this Division for acquisition work.

While this Division has given considerable assistance in the problem of adjustment for the families to be evacuated, the Farm Security Administration is bearing the brunt of this tremendous undertaking. Other Bureaus in the Department of Agriculture also have rendered valuable services in this connection.

One of the most successful performances of this kind is now in full operation in Caroline County, Va., where approximately 80,000 acres are being acquired for maneuver grounds. Here, workers from Farm Security Administration, Agricultural Extension Service, Farm Credit Administration, State Department of Agriculture, and other National, State and local agencies under the general leadership of C. B. Lanford,

County Farm Agent, have relocated 225 families in less than 2 months after work in acquiring land was started. This splendid accomplishment is the result of careful planning by the local representatives of these agencies and the farmers affected. This work in Caroline County is not an isolated case but represents what can and is being accomplished where these various agencies band themselves into an unselfish group to render the services each is best equipped to perform.

It is not amiss to pay tribute to the splendid spirit of sacrifice that is shown by the vast majority of the people who are having to leave their long-established homes. The War Department is as liberal in prices paid as is permissible under the laws governing land purchase by the Government, and is faithfully executing its trust to acquire and develop lands for national defense by the expenditure of the citizens' tax money.

Even so, those who are giving up their homes must bear many losses for which compensation cannot be provided in the land purchase. The losses, both monetary and sentimental, are being borne with a spirit of patriotism that marks these people as true sons and daughters of patriots, and sets an example for every individual and organization that is asked to take part in our National Defense Program. When the history of this period is written, these unsung thousands of rural heroes and heroines should be given a special tribute.

"LOOK AT AMERICA"

(Continued from p. 30)

ervation program in their community. No one tells these farmers what they must do or how they must do it. No one has to—they do it themselves, because they *want* to. They have sought the assistance of specialists in the science of soil conservation to help them solve their problems. But they have not signed away any of their rights to manage their farms and their affairs.

And so I say it is pure, undiluted tommyrot to believe for one instant that good, old-fashioned, country-style democracy is weak and tottering. To anybody who weeps and moans about how the dictator system gets better results than our system, point to Grand Coulee Dam. Point to the Panama Canal, the Golden Gate Bridge, the Empire State Building. Point to our schools, our highways, and railroads. Point to the soil-conservation districts—as pure an example of democracy at work as there is in the world.

REHEARSAL FOR DEFENSE

By G. H. GILBERTSON ¹

EIGHT years ago, the CCC began making contributions to a national defense program that wasn't yet born. Recently, appraising these and more recent accomplishments, James J. McEntee, CCC Director, summarized the Corps' defense aims by declaring "We are continuing to do the conservation job we have been doing, but are intensifying and coordinating our program of training youth in national defense skills."

For young men in need of jobs times were tougher eight years ago than they are now. Tens of thousands of boys past school age, who had not yet found their niches in the world, were thrown into competition with experienced men for a handful of jobs.

Not content to witness the wasting of its human resources, the Nation created a new agency to utilize

the energies of unemployed young men. It is appropriate that the task assigned youth was to help stop the wasting of natural resources so that future generations might still find them ample.

Today, the Nation can look forward to receiving a big return from its investment in youth—and sturdy, able young men are perhaps the most important of her defense assets. Since 1933, the CCC has returned to the country more than two and a half million young men of military age, physically more able and eager to defend the country that helped them weather difficult times.

Measure these 2,500,000 ex-CCC enrollees by a defense yardstick and the results may amaze you. Take the matter of health, for example—and then put yourself in the place of a CCC enrollee. Your diet may not have been up to par before you came to live at a camp, but the doctor in looking you over decides "Well, a little underweight, but otherwise fit for field work."

He then inoculates you against common communicable diseases, and after a toughening-up period you gradually find yourself able to swing a shovel or an ax all day without sore arm, back, and leg muscles. Before you realize it, outdoor exercise, regular sleep

This year the CCC has trained 60,000 operators of tractors, trucks and heavy equipment.

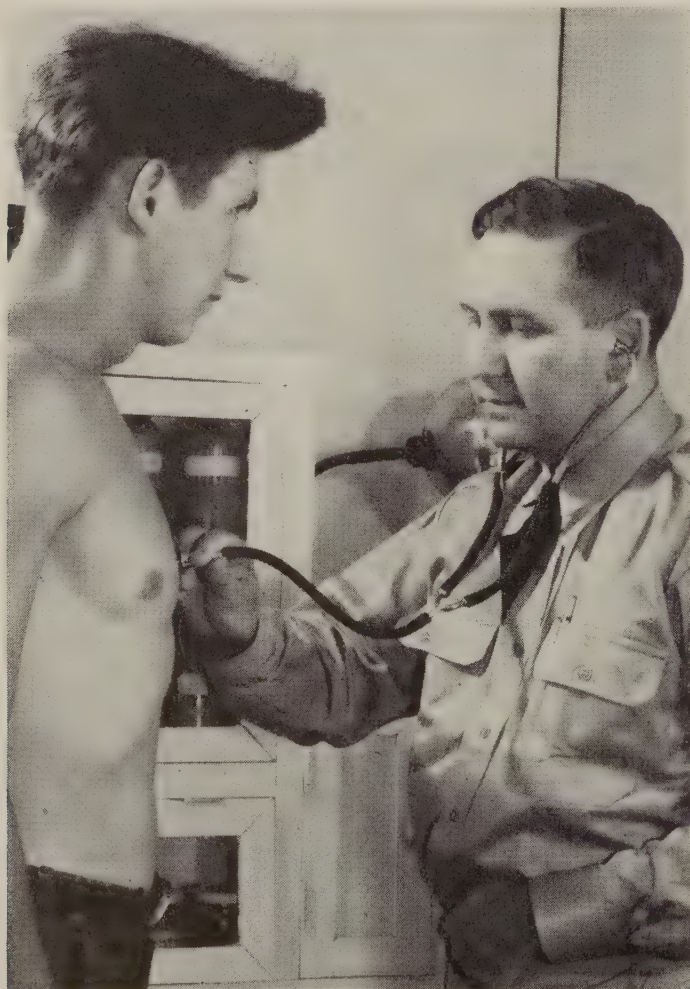


¹ Information division, Soil Conservation Service, Washington, D. C.



Retreat ends the work day.

and sound diets have built solid muscles, and soon the scale registers your gain in weight. Your teeth



Physically fit young men are among the Nation's most valuable assets.

are put in shape by the dentist serving your own and neighboring camps. The camp doctor, who is always on hand, takes care of your illnesses and injuries, if you have any.

Six months or a year of this puts you in A-1 shape, or perhaps 1-A, as they say nowadays.

From the Army's standpoint, there is more to the CCC than the high health standards of its enrollees. Enrollees, you see, bridge part of the gap that distinguishes civilians from soldiers. During the World War days, the Army learned that most men who were suddenly wrested from their civilian jobs and sent to camps had to become acclimated gradually to Army life. In a way, this was a vexing, lost-motion problem. CCC enrollees become adjusted to group association during their stay in camps. They learn the meaning of, and the necessity for, personal hygiene and sanitation. They learn the give-and-takes that are necessary when the will of the individual conflicts with the way of the group. They learn discipline. In fact, in most of the curricula of the "school of the soldier" enrollees finish the primary grades.

Early in CCC history, the Army, looking ahead, found another value in the new organization: The 1,500 CCC camps proved to be excellent training grounds for reserve officers, and since 1933, 20,000 of them have obtained experience in handling men and supplies as CCC company commanders and subalterns.

Recently, since the beginning of the defense program, CCC companies have been assigned directly to

Soil conservation work lends itself particularly well to training surveyors and mappers.

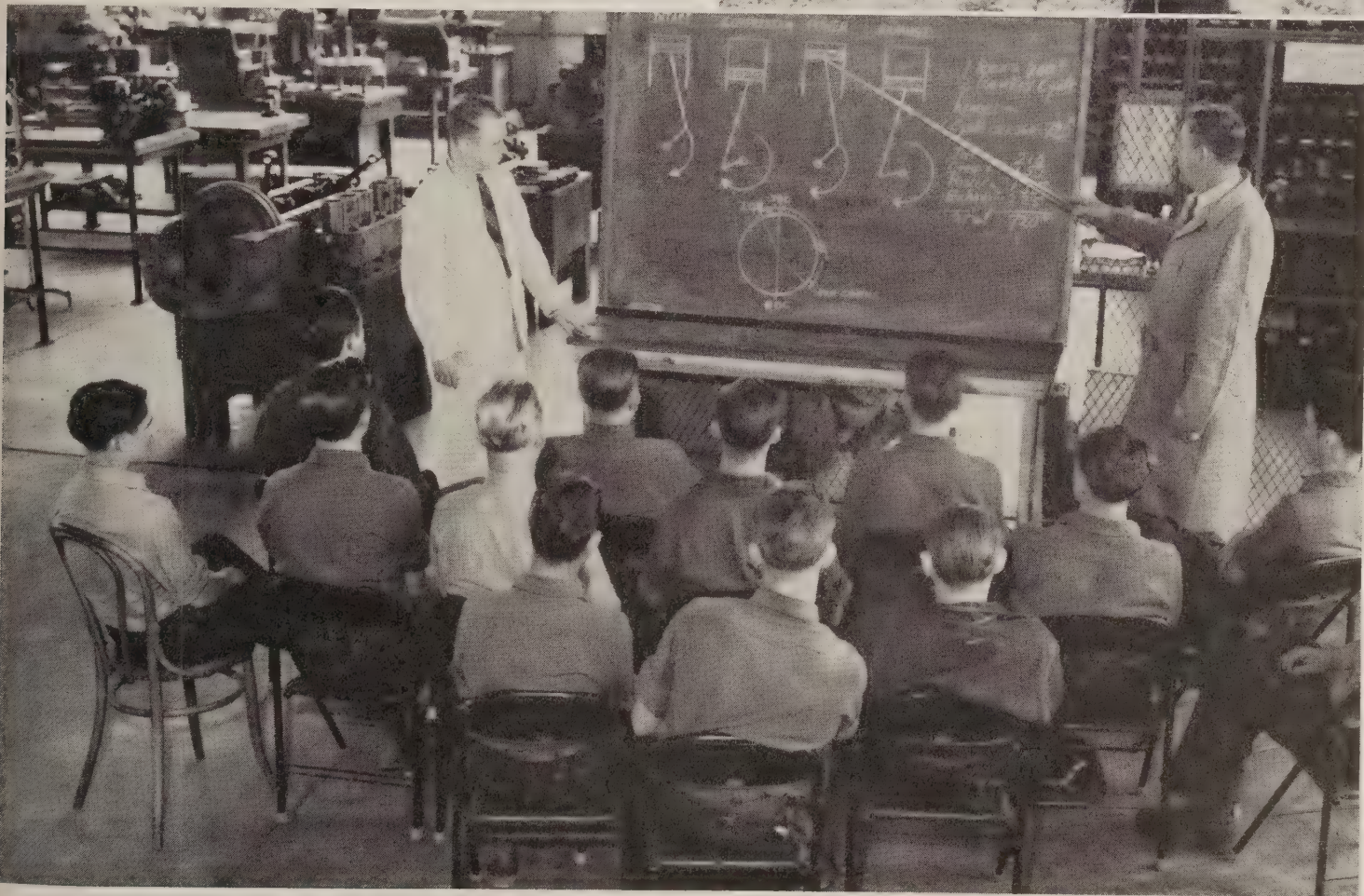
defense projects, to work at clearing land, building roads, developing drill fields, helping to construct airplane landing fields, and similar jobs needed in connection with the expanding military program.

No résumé of the CCC's part in the national preparedness program is complete without mention of its role as a training organization. In fact, training is a function of the CCC made mandatory by its enabling act. From the beginning the CCC has been a work-and-learn agency.

In this day of a possible future scarcity of trained men, the roll call of the CCC training program is sweet music to many ears. Not all enrollees have become expert craftsmen, to be sure, but a good many are prepared at least to fill the gaps as men with more experience and greater ability are needed elsewhere.

Save for supervisory positions, enrollees do all of the jobs required to operate and carry on the work program of a 200-man camp. Enrollees are cooks, trained by the Army at special schools for cooks, bakers, and mess stewards. Enrollees are clerks, draftsmen, mappers, warehousemen, mechanics, blacksmiths, truck and tractor drivers, bulldozer and drag-

(Continued on p. 43)



J. J. McEntee, CCC director, visits an auto mechanics class at the central repair shop at Salem, Va. (Standing, at left.)

FITTING LAND UTILIZATION TO NATIONAL DEFENSE

By WILLIAM R. NOBLE ¹

LANDS held under title III of the Bankhead-Jones Farm Tenant Act were acquired by the United States to effect a land-use adjustment by removing worn-out and misused lands from private ownership. The objective was to restore the lands by using them for a purpose to which they were better adapted, to relocate families occupying the land purchased, and to rehabilitate families permitted to remain in the area of adjustment.

The acquisition of land, relocation of families, and development and improvement of the land constitute the first step in the program of land-use adjustment. The completion and effectiveness of the job depends on the program of land management.

At the time a project is initiated, rather definite determinations are made regarding the future use of the land. Plans are directed toward the most intensive use that will be consistent with restoration and conservation of the land, practical from the standpoint of the expenditure required for development, and which will best serve the needs of the community by providing a basis for a better standard of living. The primary uses include grazing or pasture, forestry, recreation, and wildlife conservation.

When the land-utilization program was started it was recognized that many areas would be acquired which were well suited and strategically located for military use. With this in mind, the projects established were from time to time listed with the War Department to provide that Department with preliminary information concerning the nature and location of our areas for consideration in the event of a national emergency.

Early in 1937, War Department officials indicated an interest in securing the use of lands being acquired in close proximity to military reservations. It was agreed that, after the relocation of families and the development and restoration of the land was completed, favorable consideration would be given to these requests. Accordingly, in 1939 the Plattsburg and Pine Camp projects in New York, totaling 13,823 acres, and the Camp McCoy project in Wisconsin, totaling 9,448 acres, were transferred to the War Department and reserved for use in connection with existing military reservations.

The families living on the lands purchased were all removed to other locations where they would be able

to make a better living. The lands which were primarily unsuited to cultivation were developed to control increasing soil erosion by the building of dams and by restoring the protective cover. Trees, grass, and wildlife-cover plantations were established and certain minor recreational facilities were provided. Appropriate areas were cleared to serve the needs of the War Department. War Department officials agreed to continue the program of conservation of the soil resources and to protect the forest and wildlife resources insofar as consistent with military use. Officials of the Soil Conservation Service will no doubt be called upon from time to time for advice and assistance in this respect.

With the development of the world crisis and an increasing emphasis on the program of National Defense, officials of the Soil Conservation Service have found it necessary and desirable to cooperate closely with officials of the War and Navy Departments to fit the program of land utilization with that of National Defense. As we have been advised by those Departments as to the sections of the country in which lands were needed for camp sites, ranges, storehouses, airports, and maneuver areas, our projects have been reexamined in an effort to assist in filling those needs with least interference with our program. The examples given below will indicate the progress that has been made to achieve this purpose.

Early in 1939, War Department officials advised that an area of approximately 1,000 acres in eastern Oklahoma was needed for a rifle range. A survey was made of the Cookson Hills project in eastern Oklahoma to determine whether an area could be located which was secluded from private land holdings and was not well suited for such uses as pasture, forestry or wildlife. Such an area was located and reserved, and it is now being used by the War Department as a rifle range. This use is causing very little interference with the pasture, recreation and wildlife uses of the remainder of the project.

Early this year, War Department officials advised that several sites of approximately 600 acres were needed in northwest Louisiana as aerial bombing ranges. A survey of our northwest Louisiana project revealed that several sites could be located which were removed from private holdings and had not been made available for public use. One such area of 600

¹ Land management division, Soil Conservation Service, Washington, D. C.

acres was reserved for use by the War Department in April of this year. It is likely that one or two additional sites can be used for the same purpose without seriously impeding our program in this area which involves forestry, pasture use, recreational use and wildlife conservation. Any areas selected will, of course, have to be remote from areas subject to intensive public use.

Upon request of the War Department the Lakeland Flatwoods project in Georgia, involving approximately 8,720 acres, has been reserved for use by that Department as an aerial gunnery range. The area has a large site suitable for the landing of planes. The lands acquired are in a solid block and all families have moved to other locations. The lands were acquired primarily for the purpose of determining conservation measures that might be applied to this area to make it suitable for dairy and beef cattle production. Upon the expiration of the emergency this area, as well as those in Louisiana referred to above, will be returned to the Soil Conservation Service for a continuation of the land conservation program as originally planned.

At the request of the Navy Department, a portion of the White River project in Indiana was recently reserved for use as a site for ammunition warehouses. This project had been placed under management of the Indiana State Conservation Department, primarily for forestry uses, with the Forest Service designated as custodian. The Soil Conservation Service cooperated with the Forest Service in securing approval of the State to the reservation of a portion of the area for exclusive use by the Navy Department. The State will continue to manage the remainder of the project as originally proposed.

A few months ago the State Armory Commission of Alabama was authorized to use for an initial period of 5 years the Pea River project in Alabama. The project is being managed by the Alabama State Commission of Forestry under agreement with the Department of Agriculture, primarily for forestry, recreation and wildlife purposes. The Soil Conservation Service is the custodial agency to assist the State in this program. The management program of the State Forestry Commission is to continue, but the Armory Commission is authorized to use the area from time to time as a camp site and maneuver area for the National Guard. National Guard troops will be given equal privileges in the use of recreational facilities such as are afforded to the general public. It is not contemplated that this arrangement will interfere to any considerable extent with the land-utilization program being carried out.

From time to time, sites have been made available to various Federal and State agencies for airway beacons, monitoring stations, temporary maneuver and camp sites, and emergency airplane landing fields. At present, consideration is being given to making available to the Southern Illinois Normal University an area of approximately 1,200 acres in the Crab Orchard project for use as an airport for student pilot training. The university is conducting its training program in cooperation with the Civil Aeronautics Administration and will be governed by the requirements of that agency in the use of the airport. When the need for this use of the land no longer exists, the land will revert to the United States.

Requests have been received from the War Department and the Navy Department for sites to be used for national defense purposes in various parts of the United States. Immediate consideration is being given to these requests to determine whether or not suitable sites are available within Land Utilization projects.

Although military use is not entirely consistent with the purposes for which title III lands were acquired, in many instances it is the highest use to which the lands can be put, especially during the present national emergency. It is recognized that military use will in most cases interfere to some extent with the land-utilization and conservation program. On the other hand, such interference may be offset in some instances by benefit to local people as a result of employment afforded them by such use of the lands.

It is intended that in carrying out the land utilization program the Soil Conservation Service will serve to the fullest extent the needs of the National Defense Program, and at the same time will attain the objectives for which the lands held under title III of the Bankhead-Jones Act were acquired. Requests of the War and Navy Departments will continue to receive priority, but an effort will be made to serve the needs of those Departments with least interference to the program of land utilization and soil conservation.

LAND AND PEOPLE

Out of the logbook of the Chief of the Soil Conservation Service come intimate notes of activities on the soil-defence front, in the form of an engrossing article titled "Land and People" tabbed for publication in the September issue.

“A TRIUMPH OF COMMON SENSE”

Often reiterated in these fluid days are questions regarding the compatibility of defense production with soil conservation. Will there be another plow-up program? Must we set aside all plans for the permanent husbanding of agricultural resources because of urgent immediate needs? Elsewhere in this magazine is an article by F. E. Charles which meets the issue squarely and should do much to clarify the thinking of troubled minds. And from far away Harpenden, England, comes a sane statement, in long perspective, reflective of a similar trend of opinion: a short article in *SOILS AND FERTILIZERS*, published by the Imperial Bureau of Soil Science under the title, “War’s Opportunity.” This statement is reproduced herewith.—*The Editor.*

THE last war immensely accelerated the process of land exploitation that had been gathering momentum over most of the world for some decades previously. In the United States, in particular, huge areas of virgin prairie land were ploughed up and bled to the bone in order to satisfy the unprecedented demand for food that came from hungry and battered Europe. Much the same thing happened in other countries. During and after the war production was all that mattered, and land deteriorated rapidly until erosion became ubiquitous. Subsequently strenuous efforts were made to stem the swelling tide of erosion, and within the last few years it has seemed as though, taking the world as a whole, the lessons of erosion had been learnt and agricultural systems were being slowly evolved which, instead of exhausting the soil, would gradually build up fertility and stabilize the land. The story has been told again and again. Its first chapters were dismal, but the last recorded chapter promised to lead on to the greatest of all man’s triumphs over Nature. Will that chapter be closed by the present war? Shall we again embark on a policy of reckless production to satisfy insistent present needs, undoing the good work of the last few years, exposing the soil once again to the ravages of its most dangerous enemy?

It may be taken for granted that present, war-time demands on the land will, if humanly possible, be satisfied regardless of the cost to the future, and that if the world is hungry after the war every effort will be made to satisfy its hunger, again regardless of the cost. But this need not result in another world-wide deterioration of land; on the contrary, there is every

reason why the war should give an added stimulus to the conservation movement. The last war accentuated an already existing trend towards exploitation; this war should likewise accentuate the recently established trend towards conservation. President Roosevelt is reported to have stated that a ploughing-up programme will not again be countenanced in the United States. Although it would probably be beyond any man’s competence to prevent a repetition of what happened after the last war should similar post-war conditions return, the President’s statement may be taken to express the American people’s fear that their successful conservation work may, and their determination that it shall not, be brought to nothing. The fear seems groundless for several reasons—for example, the post-war situation which agricultural exporting countries envisage and are already taking tentative steps to meet is not an insatiable demand for new produce at irresistible prices, but an unwanted accumulation of grain surpluses which could not be exported during the war. Apart from the discredited method of destroying surpluses the problem would best be tackled by accelerating the change-over which has already been initiated from extensive cereal culture to soil-conserving crops. Add to this the obvious intention of Great Britain and (presumably) other European countries to develop agricultural self-sufficiency to the utmost, and it will be seen that in the United States and the British Dominions present conditions are, and future conditions probably will be, remarkably favorable for the execution of sound soil-conservation policies.

An analogous state of affairs exists in the tropical dependencies of the British Empire, although perhaps the natural assumption that war must restrict peacetime programmes of social reform has dimmed recognition of the immense possibilities opened up by war conditions of getting an agricultural basis for soil conservation firmly and permanently established. It is unlikely that many unwieldy surpluses of tropical produce will accumulate, nevertheless, owing to the severe contraction of trade with Europe, it is becoming imperative for tropical countries to attain a greater degree of self-sufficiency in foodstuffs than has been necessary hitherto. This in itself is encouraging the development of self-contained agriculture which, as numerous examples in both tropical and temperate regions have proved, can be made very conservative of soil fertility. So long as cash crops for export can procure from abroad not only sufficient food, but also

some of the amenities of a more advanced culture it is natural that any movement towards a more self-contained agriculture should be strongly resisted—at least when it approaches a point that satisfies the minimum requirements of the soil for conservation. Beyond that point it is almost impossible to advance against the opposition of economic forces, but opposition breaks down in face of a threat of hunger. More home-produced food at any sacrifice then becomes the order of the day, and an agricultural revolution can be carried through on a scale that would be impracticable under “normal conditions.”

Obviously, an intensification of indigenous food production can be made the occasion for exhausting the soil, but in most circumstances the development of a more self-contained agriculture can and should go hand in hand with the parallel development of a sound conservation policy. The one should help the other. A short-term programme, put into operation with the intention of abandoning it when the emergency has passed, might well do more harm than good to the soil, but a long-term programme must by its very nature depend on the building-up of soil fertility, and therefore on soil conservation. In general those conservation measures, both technical and social, which have proved their worth, if not their applicability,

in the tropics can be adapted with advantage to the task of attaining greater and lasting agricultural self-sufficiency. They will become more easily applicable if the people learn that they must rely for their day-to-day existence on the continuing fertility of their land; but to achieve their secondary purpose of stabilizing a largely self-contained agricultural system as well as their primary purpose of conserving the soil they must be coordinated as part of a planned and, under the exigencies of war, unavoidable agricultural revolution. How far that revolution must go in any particular country, or whether it is ultimately desirable on economic grounds, we cannot say, but socially it can be made beneficial if it is based upon a forward soil-conservation policy. The need for more self-contained agriculture in war time is universally recognized. The desirability—at all times—of its natural complement, a comprehensive soil-conservation policy, is also widely recognized, although nowhere in the colonies has such a policy become a reality, largely because of the difficulties of effecting just that kind of agricultural revolution which the war is making inevitable. It would be a tragedy if, in planning to meet the war-time problem of a threatened food shortage, the all-time problem of soil conservation were lost sight of. It will be a triumph of common sense if each is made to solve the other.

REHEARSAL FOR DEFENSE

(Continued from p. 39)

line operators, axmen, sawyers, rough carpenters, quarry workers, and construction workmen.

Some are leaders and assistant leaders, exercising limited authority by virtue of their proved ability. Others are specialists, able to run accurate survey lines, or to do plane-table mapping. They have learned their jobs under the watchful eye of technicians and foremen who, because they realize they are helping to mold careers, are exacting and thorough.

Since the defense program began, the CCC has revamped its training objectives with all-out preparedness in mind. In cooperation with Federal and State vocational authorities, new avenues of useful training have been opened to enrollees. Today CCC men sit shoulder to shoulder with thousands of other young men who attend evening vocational classes to learn defense skills.

With the help of vocational authorities the CCC has also established special programs of defense value. One, at the Vista, Calif., soil conservation CCC camp, has been in operation for more than a year. The

course is in aviation mechanics, and its purpose is to develop men who can help fill the needs of aircraft industries engaged in the production of defense materials. A competent instructor is furnished by the Escondido high school. Interested aircraft manufacturing concerns donated materials. By attending classes during three months' leisure time, enrollees learn the routine and tools used in aircraft assembly. Proof of the value of the course is attested by the willingness of one manufacturer to employ all the enrollees who complete the course. Already more than 200 enrollees have been “graduated” and are now employed by aircraft industries.

In terms of work accomplishments, the CCC has done and is doing a big job. The work of enrollees has increased the natural wealth of the land by hundreds of millions of dollars. The sweat of the CCC has made the United States a better place to live in, a country more worth protecting and defending and, in terms of reserve resources and reserve man power, a Nation more able to protect and defend itself.



Surveyors with special knowledge of the requirements of aerial field control, plan and execute the work. They must be capable of computing regular traverse and triangulation work.



In the SCS photographic laboratory a trained group of men is engaged in the inspection of aerial negatives, the printing, rectification, and enlargement of photographs from films, and the compilation of mosaics.

CARTOGRAPHIC DIVISION AND NATIONAL DEFENSE

By HARRY T. KELSH ¹

THE Cartographic Division of the Soil Conservation Service takes pride in the fact that it has developed, in its general map work, the fastest system for making maps of good accuracy from aerial photographs that is as yet available. The speed of production has been made possible by the development within the Division of the "slotted templet" system for extension of radial control. In a very few words, this system creates graphically, upon a desired grid, or map base, with very little ground control, an

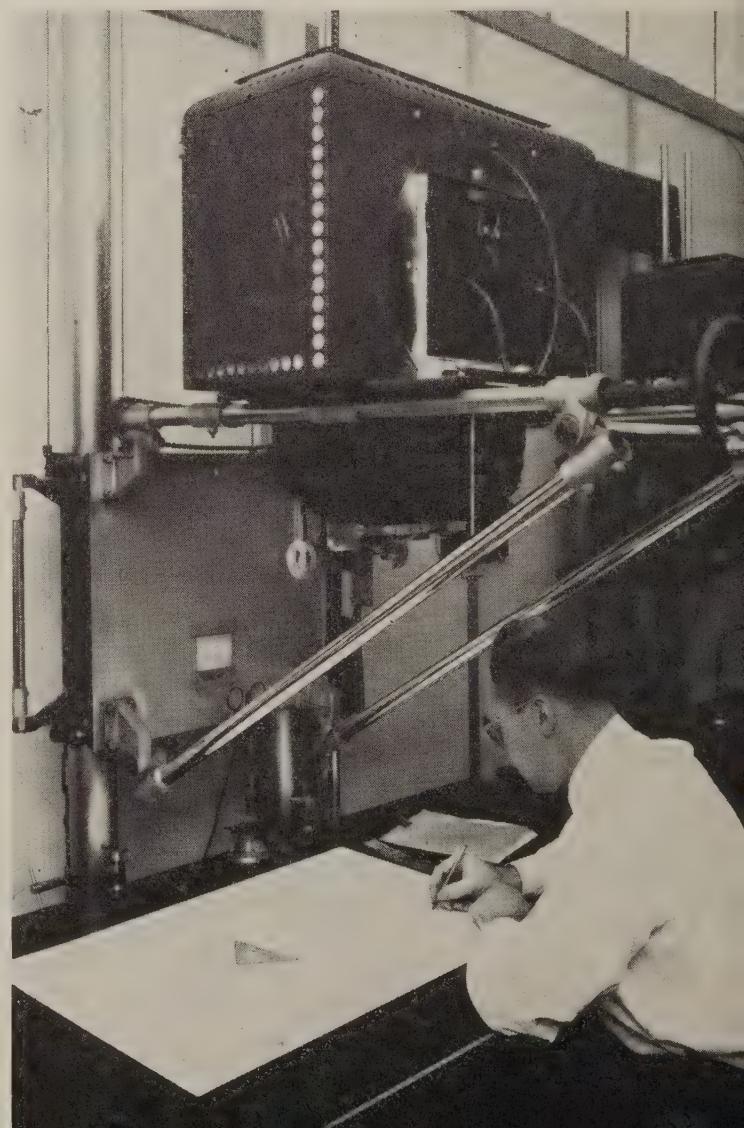
¹ Head, map control section, division of cartography, Soil Conservation Service, Washington, D. C.

accurate network of actual positions of identified points on the photographs, to which the detail of the photographs can then be correctly applied.

The system described above may be particularly beneficial under war conditions where usually only a small amount of initial ground control is available. Its value and work of the Cartographic Division with this system are well recognized by the War Department and other mapping agencies. At the present time the Hydrographic Office is ordering a duplicate of the apparatus developed here for cutting slotted templets.

The method of securing the necessary control points for map making is not the only development of the Cartographic Division. The map detail must still be drawn in, and in this connection the Division was materially responsible for the development of the overhead projector for this work. The photograph is placed in this projector and the image is projected upon a plotting sheet below. The machine, by suitable manipulation, brings the image into desired position and size. At present twelve of these projectors are in operation here, and we have recently added a complete multiplex unit to our equipment.

With the control established, the detail is transferred from the photographs by men trained in recognizing essential map information.





The office routine by which the photographs or templets representing them are placed in correct map position has called for a new system of map control. Due to the simplicity of the method developed here, it is especially applicable to the defense program.



Names, culture, and other data are rapidly placed on the map by mechanical processes.

A number of maps of small areas already have been called for to meet Defense needs. The most important thus far turned out is for an experimental laboratory site adjacent to the Cleveland airport.

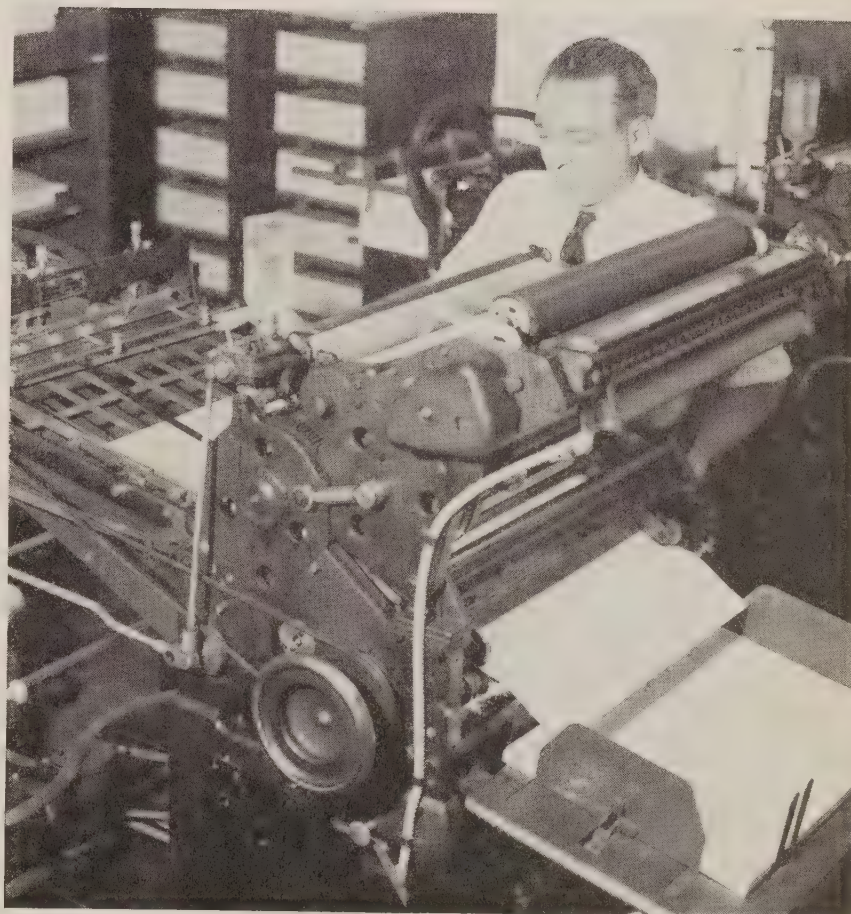
It has been said that while the Department of Agriculture is the largest governmental user of maps, the agency as a whole has not been map-minded. Until comparatively recently the Department was willing to take whatever was available in the form of published maps and make them fit the needs as well as possible. With the establishment of the Soil Conservation Service, and our need for large-scale maps upon which detailed agricultural studies could be surcharged, it was found that in most instances it was no longer possible to use the published maps of agricultural areas. The Cartographic Division was organized to meet this need. To many in the Department it is still difficult to realize that in the last 6 years a mapping organization has quietly grown up in the Soil Conservation Service that is today one of the most up-to-date in all the Government bureaus and is rec-

ognized as such by the other map-making organizations.

This Division came into existence after it had become clear that mapping by use of aerial photographs was rapidly superseding all other methods. Because of this, only the latest form of equipment for use in this work has been purchased and much equipment in this specialized field has been developed within the Cartographic Division. The Divisional headquarters at Beltsville is set up to render a complete mapping service, from original planning to final printed reproduction. The photographic laboratory ranks well with any in the country. It is equipped to turn out as many as 40,000 photographs per month, and to do precision enlargement work up to a camera capacity of 26'' x 36''.

This part of the Division is also equipped to make either controlled or uncontrolled mosaics from the individual photographs. This work is highly technical and specialized, requiring a knowledge far beyond the requirements of ordinary photography, since the photographs must be matched for general tone and each individual print trimmed and applied to the

(Continued on p. 58)



The finished manuscript map is transferred to the photographic laboratory and there, through the use of photolithographic methods, is transformed into a printed map.

THE PERPLEXING CASE OF INDIAN CORN



A modern planting of Indian corn in Arizona.

By WILLIAM R. VAN DERSAL¹

FROM Canada to Patagonia corn was being grown by American aborigines when European civilization "discovered" it. Northern Indians used it and showed early colonists how to grow it in hills, each with a fish for fertilizer. The Mound Builders had it, and the more ancient Incas, Aztecs, and Mayans depended heavily upon the plant for their food. Corn of today indeed is not much different from the plant found by Columbus. Our well bred varieties display greater uniformity, we have developed superior dent varieties, and we have discovered ways to produce high-yielding hybrid corn, but to the Amerindian belongs the credit for developing the plant from its wild ancestors, and for bringing it to an extremely high degree of productivity (6).

In many parts of America the growing of corn has come to mean almost the same thing as farming. Parts of 11 States, from Ohio west to Nebraska and South Dakota, comprise the familiar Corn Belt of the present day, although in 1840 the belt of greatest production lay across Kentucky, Tennessee, and Virginia (2). We think of the deep South as cotton country, yet Georgia and Alabama had an average of 27 percent more land in corn than in cotton during 1928-37. In the same period Georgia alone had an average of 10 percent more

land in corn than Ohio—one of the Corn Belt States. In fact, in the most remote localities corn is commonly found occupying the greater part of the acreage devoted to crops, if it can be grown at all. Actually corn is grown in every State in the Union—only a few thousand acres of it in Nevada to be sure, lowest of all States—with altogether about 2,500,000,000 bushels from some 90,000,000 acres for the entire country. The United States, in fact, usually produces well over half the entire world supply.²

Consumed directly or in the form of meat and other animal or processed products, corn is a principal source of food for the American people. The grain is very nutritious, as it contains a high percentage of easily digestible carbohydrates, fats, and proteins. Corn may reach the table as cornbread, hominy, corn pudding, an alcoholic beverage, or "on the cob." It may be poured on corn scrapple in the form of sirup, sprinkled on fruit as sugar, or put on salad as the oil base in the mayonnaise. The crust on bread may have been painted with corn dextrin to give it its soft brown color, and ice cream, candy, and even chewing gum manufactured from corn products may conclude many an American dinner. Some figures on this score are of interest. From corn we produced in 1939³ approximately:

¹ The author, who is senior biologist, Soil Conservation Service, Washington D. C., gratefully acknowledges information supplied by M. T. Jenkins of the Bureau of Plant Industry, as well as the helpful suggestions and criticisms of T. D. Johnson, A. T. Semple, E. H. Reed, and Edward H. Graham, of the Soil Conservation Service.

² Figures from Agricultural Statistics, 1940. U. S. Department of Agriculture.

³ Figures collected by the U. S. Bureau of the Census in 1940, rounded off to the nearest hundred thousand.



A crop of corn is maturing somewhere in the world every month of the year. This Nebraska field is unsafely used for corn, as the poor plants in the left foreground plainly show.

1,120,300,000 pounds of cornstarch worth	\$29, 300, 000
467,100,000 pounds of corn sugar worth	13, 600, 000
957,300,000 pounds of corn sirup worth	21, 100, 000
106,500,000 pounds of corn dextrins worth	3, 500, 000
65,100,000 pounds of corn oil, oil cake and meal worth	584, 000

It is estimated that in the United States we eat about 16 bushels per person each year in one form or another, although it is the indirect route that most corn follows to become food for man. Between 5 and 6 pounds of corn fed to hogs will make a pound of pork, for example. The great corn-hog agriculture with all its complex economic interrelationships comes about because the hog is used as the principal direct consumer of corn. Indeed, the pork industry of the United States depends almost entirely on corn, using about 40 percent of the total crop raised. But many domestic animals other than cattle and pigs are fed on corn, and corn is fed in other ways than as grain. The practices of fermenting green corn in silos and of feeding stock on stover—the cornstalks after the ears are removed in the field—are well known to every farm boy.

An interesting sidelight on the esteem in which corn is held as a food is provided by its wildlife record. According to the files of the Fish and Wildlife Service, more kinds of wild birds and mammals feed on corn than on any other herbaceous plant, including even wheat and alfalfa, both of which are widely used by wildlife as food. In fact, 140 kinds of wildlife are recorded as utilizing corn in their diets. The animals are noted on the back

cover of this issue, and of course the competition between crows, blackbirds, and man for the corn crop is well known.

During recent times immense reserves of corn have been accumulated in this country. The total quantity on hand on April 1 of this year amounted to 1,423,000,000 bushels, about 16 percent of which



Maize was the basic food plant wherever Indians practiced agriculture in America. Here corn is ground in a bin at the summer hogan of an Arizona Indian.



The practice of planting corn up and down hill instead of on the contour makes corn as well as other clean-tilled plants dangerous crops. A slight shift to align these corn rows with the terrace would have saved large quantities of soil.

was owned by the Government, 21 percent was under loan, and the remaining 63 percent classed as "free corn," that is, in private hands without a loan. Last crop season's carry-over amounted to 695 million bushels, and present indications are that next year's will be somewhat larger—possibly to the extent of 50 million additional bushels.⁴

So far we have considered corn in an entirely favorable light, just as most farmers always have. The plant forms the basis for a major agricultural endeavor, provides tremendous quantities of food for man and his livestock to say nothing of wildlife, and is of great commercial importance both for itself, for stock feed, and for the derivative products manufactured from it. Scarcely more than 10 years ago, however, some facts began obtruding into this picture that threw an unexpectedly sinister light on the use of corn.

In reality the first of these unpleasant facts was apparent many years ago. Then we became aware of the fact that the annual average yields of corn for the 63 years preceding 1929 look about the same as the average for 1920 to 1929. The hidden significance here is that yields should have increased, because corn varieties were improving steadily just as methods of farming were generally becoming

more efficient and economical. But corn yields did not increase. In other words, soil productivity declined so greatly as to offset otherwise substantial gains made by plant breeders and progressive agriculturists. In addition, corn has been grown in many regions on extensive areas of poorer soils on which yields are lower, and this of course also tends to depress average annual yields per acre.

The second set of facts came out of studies made at many experiment stations on soil losses under different crops and cropping systems. It was discovered—and this has been repeatedly confirmed since—that clean-tilled plants such as corn and cotton, farmed under old and long-established systems, induce more erosion than any other types of crops. The trouble was not with the plants themselves; corn, for example, is not inherently bad even though its water and nutrient requirements are high. The fault lay with the way corn was being grown. When corn is planted and cultivated up and down hill, when it is used continuously on the same land, when it is planted on steeper slopes, when no cover crops are used with it, and when it is harvested without a cover crop following it, then serious soil losses must be expected. Under such conditions we now know that corn is an unsafe, not to say an undesirable crop.

⁴ Figures and estimate from Feed Situation for April 1941, issued by the Bureau of Agricultural Economics.



Corn under patch farming planted "with a shotgun" according to the farmer. Slopes like these belong in permanent cover. If there is any cornland in this picture, it is in the center on the valley floor.

More recently another unpleasant situation has developed with respect to corn as well as to a number of other agricultural commodities. Briefly put, the volume of agricultural exports from the United States has shown a steady decline. Considering the average for 1909 to 1913 as a standard, the average volume of such exports for 1934 to 1937 dropped to 57 percent of what it formerly was. In July to September of 1939 it was 58 percent, and by July to September of 1940 it had fallen off to only 28 percent of the earlier "par" figure (3). The war in Europe with all its related effects has caused a virtual disappearance of our foreign markets, as one writer puts it, and corn has suffered along with the rest of our exports (3).

Hitler's conquests in May and June 1940, and the increasing effectiveness of the British blockade, closed the European market for our farm products (10). Not a single bushel of corn, for example, has gone to Germany, Denmark, Norway, Belgium, France, and some other countries since October of 1940.⁵ Furthermore, predictions are being freely made at present (8) to the effect that when peace

finally comes, the United States never again will find as large an export for its farm products as in the 1920's. In that event a major readjustment appears inevitable.

We are now in a position to consider what may happen to corn in the light of its great value as food, the harm wrought to soil by unsafe methods of its culture, the surpluses of corn available and expected, and the fact that corn and corn-equivalent exports have declined so greatly. As we do so we need to bear in mind that corn is a food in which the Nation is vitally interested, not only in the present defense emergency and in case of war, but also in peacetime.

The defense effort of the United States has brought sharply into focus the need not only for food in quantity but for the right kind of food. Recently, R. L. Mighell put the matter pungently when he said:

The most serious adjustment problem for this middle-term war period . . . comes down to a matter of producing additional quantities of certain foods needed to further the war effort . . . producing these in the regions and areas where they can be obtained most efficiently and with the least troublesome after-effects (8).

Now while corn is an excellent food, it is essen-

⁵ Figures from the Office of Foreign Agricultural Relations, U. S. Department of Agriculture, as of March 31, 1941.

tially a carbohydrate and therefore only contributes to a balanced diet; thus it cannot be relied upon as the sole article of food. This is one of the many reasons why, in the face of enormous reserves of corn as well as wheat, the Department of Agriculture has asked farmers to raise more foods of high protein and vitamin content. To assure farmers of adequate markets and to provide supplies for defense purposes, price supports have been placed under hogs, the direct consumer of corn, and several other products; but there are no such guarantees for corn itself. This, it is hoped, will result in conversion of reserve foods such as corn of which we have too much, to foods such as pork of which we are in great need. In the meantime the crop-acreage control program of the Agricultural Adjustment Administration, designed to reduce acreages of corn, oats, and other erosion-inducing crops and to increase the amount of land devoted to grass and hay, has tended to reduce corn acreage. Coincident with work of the AAA, the Soil Conservation Service and soil conservation districts, in driving forward on a program of proper land use, have been actively engaged in taking corn and other clean-tilled crops from unsafe slopes and converting such land to permanent cover useful for hay, pasture, woodlands, or wildlife. This does not always or necessarily reduce corn acreage, but in many sections the tendency is in this direction.

There is no doubt that Federal agricultural action programs such as these are resulting in substantial reductions in land devoted to corn, as compared to permanent cover crops. Corn acreage in the 6 central Corn Belt States dropped to 32 million acres in 1940 compared to the 39 million average for 1928-32—a drop of 19 percent—according to a recent study (11). Not all of this cut should be ascribed to Federal programs, since drought conditions have operated very forcefully also. That such reductions in acreage are likely to continue seems clear since the soil conservation movement is gaining increased momentum daily. Eric Englund of the Bureau of Agricultural Economics declares that “unless the war and the defense effort should absorb public interest and resources to such an extent in the next few years as to preclude for a time full continuation of the land use and conservation programs already under way, it is probable that these programs will go forward, as the basic reasons for them will remain” (3).

Having taken due note of at least some of the more important factors operating to decrease the amount of land devoted to corn, we may turn our attention finally to the possible ways in which such an important food can be handled without soil wastage. In doing so we must keep in mind the disastrous effects of our agricultural mistakes of the last war when erosion was needlessly initiated on so many thousands of acres that should never have been plowed. There are three possible ways to deal with corn:

1. Soil-conserving practices can be applied wherever corn or other clean-tilled crops are grown. For corn these include a rotation system under which the land is exposed to erosion only a small part of the time; contour farming, with small furrows and ridges left by implements, either alone or in combination with terraces, acting to hold water; strip-cropping, whereby any run-off of water resulting from a break in contour checks is interrupted in its downhill rush by a strip of close-growing vegetation; cover cropping, to protect the soil from washing during the season when corn is off the land; and stubble mulching, whereby the cornstalks are left to help prevent soil blowing, to hold snow, and to minimize soil washing (9). These practices, adapted to soils and conditions as local variations require, can make it safe to grow corn. But, especially in view of the defense emergency or in case of war itself, these practices to be effective must be widely applied.

2. Proper land use combined with the use of the new, high-yielding, hybrid corn can be made to result in corn yields sufficiently great to offset considerable reductions in corn acreage. For example, class-1 land, i.e., land on which erosion-promoting crops can be grown without danger of appreciable accelerated erosion, must be the land used to grow corn if soil destruction is to be prevented.

At the same time, in view of increases in yields up to 35 percent from hybrid corn (4), such superior types can be expected to concentrate production on the smaller acreages of the best land. A large number of hybrid corn varieties have been released for commercial production, and although those adapted to the Corn Belt are in the lead, hybrids for other parts of the country, including the South, are rapidly coming into use. More than 25 percent of the national acreage is now in hybrid corn, and in some Corn Belt States nearly 90 percent of



Corn safely used on gentle slopes in Illinois. It is on the contour, in a good rotation including a year of red clover, and in alternating strips with timothy-alfalfa.

the corn acreage is devoted to the hybrid varieties. It is worth noting that in concentrating hybrid corn on class-1 land, the least productive acreage of other classes is taken out first—which tends to have a less depressing effect upon corn production than might be expected.

3. Our last and obvious possibility is to do away with corn altogether. Such an eventuality as this at first sight appears unthinkable, yet many agriculturists have given serious consideration to the idea for many years. Sherman E. Johnson pointed out in May of this year that the elimination of corn will depend upon agronomists developing a system of grassland farming that will yield as high a return to farmers as a corn-hog system (5). It is worth recalling here that the 1940 acreage of corn in the five principal Corn Belt States was the lowest in 40 years. At the same time the acreage of tame hay has increased about 9 percent over what it averaged from 1928 to 1932 (5).

No one can foretell the future and predictions concerning corn, involved as it is with remarkably complex social and economic forces, are certainly unwise in view of the chaotic international situation. Yet, as Secretary Wickard wrote only a short time ago, "We are engaged in a great defense program . . . which is so important that it obscures the less valuable of our previous concerns and emphasizes the value of our more enduring tasks . . ." (12).

It would indeed be strange if corn, a truly American crop and foundation stone of the greatest food chain in America, were found wanting in the enduring task of readjustment in old and wasteful systems of agriculture unsuited to America.

Whether corn remains a heritage or becomes history lies in the future of a strangely changing world.

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L. L. Harrold writes in September of "Rains on the Plains." He gives evidence of the effect of certain crops and certain methods of cultivation in "taking the top off a flood peak."



A good pasture, practically free from weeds, in the Corn Belt.

BUILDING A SOD DEFENSE

By C. R. ENLOW¹

OUR boys need to be conditioned for defense. So does our soil. We have abused our soil by misuse and by neglect until it is eroded and has lost productiveness. Now it is in need of overhauling. Richard Bradfield, while at the Ohio Agricultural Experiment Station, pointed out that loss of organic residues from continuous cropping has been the means of destroying the natural structural aggregates of the soil so that, in many instances, 25 to 30 percent more soil is crammed into a cubic foot than in early days when virgin soils covered our land. This has reduced ventilation and water storage of the soil; it has increased flood hazards, and it has intensified periods of drought.

In England, nearly 4,000,000 acres of grassland have been plowed since 1939—this in addition to the more than 8,000,000 acres reported in 1939. England has been following a grassland agriculture for some time and the soil is in good condition; it can be plowed to produce food crops for several years without serious results. We in the United States are only beginning our grassland program, and it takes time to rebuild soil or condition it for intensive cropping. Fortunately, we have immense acreages of cropland, a wonderful defensive resource. But it isn't in top-notch condition, or even good condition, and we should use all our efforts to improve it so that we may be prepared for whatever is in store. Being ready for any emergency is a tremendous advantage.

We have seen a considerable increase in the acreage of grass, legumes, and other sod crops throughout our country in recent years, and it is now generally recognized that this is an ideal way to preserve and actually improve our soil. Very little information is available, however, from the economic angle. If we

hope to make progress with the soil improvement work, we must learn whether or not such a practice is profitable. It seems worth while to give here a few of the recent developments to indicate the possibilities in increased income, as well as soil defense from grassland farming.

With farmers everywhere intensely interested in utilization of grass and legumes as silage and hay, certainly it becomes apparent that they are interested in growing more of these crops. Furthermore, we cannot accept this movement on the basis of soil conservation alone, as no farmer can afford to change his cropping system to save his soil if it is a losing proposition financially. Considering the extent of the interest, it must be that the farmers realize that they can produce dairy products at a lower cost—otherwise the interest would not be so general. Evidently, the grassland type of farming, which is so essential in any soil defense program, has economic as well as conservation possibilities.

For some time it has been recognized that soil erosion and wastage is the consequence primarily of wrong land use. Our Service has made a real effort, and with considerable success, to gain general recognition of this fact. While we have been working to gain recognition of waste by erosion, however, we have noted a general impression to the effect that sloping and eroded lands need only be seeded to sod crops and they will immediately become a source of profit. This impression must be pointed out as erroneous, as our sod crops need plant food and moisture in order to make good growth just as do grain and other crops. We, all of us, have made an attempt to place a tremendous acreage of land in permanent pasture and meadow, but we cannot expect it to be profitable without the addition of plant food in the

¹ Chief, agronomy division, Soil Conservation Service, Washington, D. C.

form of fertilizer, lime, manure, and other plant food carriers. Much of this land should be given further consideration, because from the standpoint of the farm economy it is still a losing proposition. Undoubtedly, a large portion of the acreage should be planted to forest trees..

If we expect to maintain our more productive lands in good condition for generations to come, we must make up our minds to follow a program of soil maintenance and improvement rather than one of continuous depletion. This means that the sod crops should be brought into the rotation with cultivated and grain crops. Already it has been proved that such a change is essential from the standpoint of preservation of the soil, on land subject to erosion, and more evidence is accumulating to show that this practice is profitable. It may turn out to be fortunate that we are forced by soil erosion to change to more profitable soil-management practices.

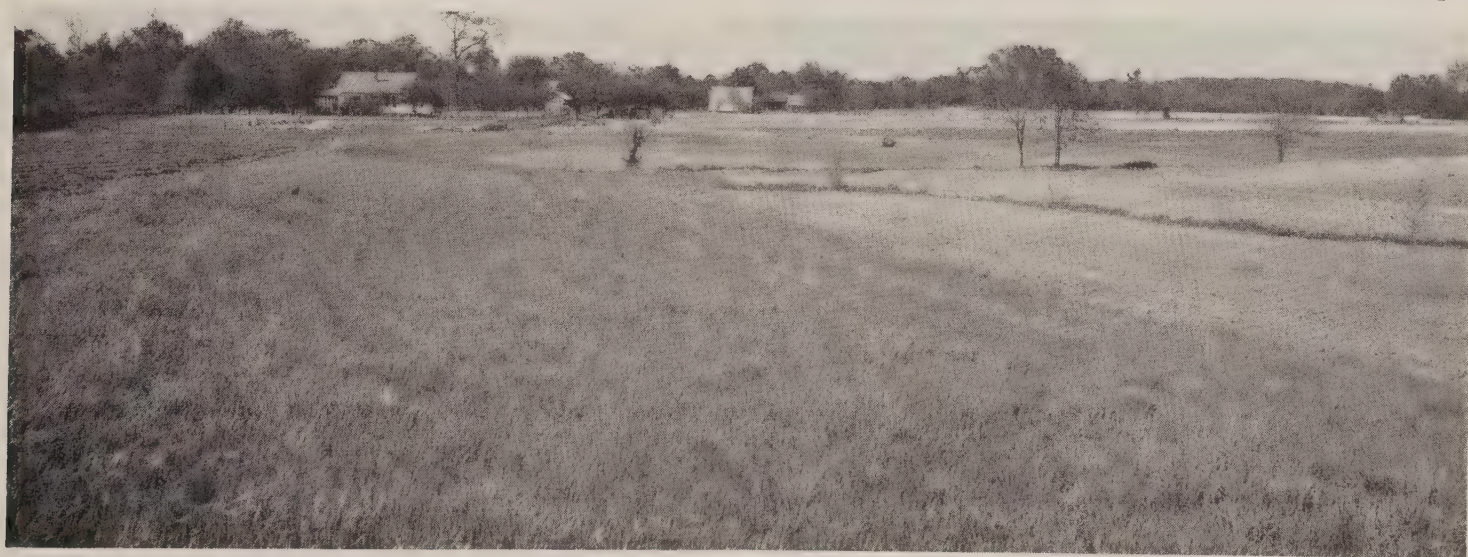
In the June issue of SOIL CONSERVATION, Mr. Semple gave some pertinent information in an article entitled "A Safer Use of Land." He pointed out that results from the New Jersey and Ohio Experiment Stations showed that grass and legume silage cost considerably less to produce than corn silage, and in addition have a higher protein and vitamin content. In the Wisconsin Agricultural Experiment Station Circular No. 299, entitled "Grass Silage," it is stated that where a legume silage is fed with legume hay, or even with mixed legume-grass hay, the grain mixture may be merely home-grown grain like corn and oats, which will make a balanced ration for all but very high producing cows. Experimenters at the station do not find that legume or mixed legume and grass silage gives any increase in quantity of milk produced over good corn silage in winter rations, yet undoubtedly there is an increase when this ration is compared

with the poor or only fair rations frequently fed to dairy cows. It is pointed out that alfalfa silage contains an unusually large amount of carotene, which is largely responsible for the golden color of milk. Feeding silage with a high carotene content naturally increases vitamin-A content of milk.

In Minnesota a common ration fed to dairy cows is 40 pounds of corn silage, 10 to 12 pounds of alfalfa hay, and 8 pounds of grain daily. Mr. Hanson, extension dairyman of the Minnesota Extension Service, recommends 25 pounds of corn silage, 20 pounds of alfalfa hay, and 4 pounds of grain. This is a much more economical ration, and according to Mr. Hanson is quite as productive. It is immediately apparent that the use of such a ration, if widely adopted, would have a revolutionary effect on the cropping program of the State by materially decreasing the corn acreage and increasing the acreage of sod crops.

In our Southeastern States, an effort is being made to develop low-lying lands into pasture. Much of this land at present is in brush, is in need of drainage, subject to over-flow, and has very little practical value in its present state. When conditioned and put in pasture, one acre will produce as much feed as approximately 15 acres of hill land pasture. Under these conditions it seems quite logical, from the standpoint of soil conservation and proper land use, that the bottomland be prepared for pasture so that much of the hill land, which is responsible for the silting and poor drainage found in the bottomland, can be planted to trees and protected from grazing.

On the other hand, with the acute shortage of crop land per farm in the Southeast, much of the hill land will have to be planted to kudzu in order to secure an adequate supply of hay. Already 200,000 acres of kudzu have been planted in the Southeast, mostly on land that is not adapted to the production of row crops.



Cotton land under a pasture cover of red clover and grasses.

When the earlier plantings were made, it was assumed that the land would remain permanently in kudzu, but it has been shown more recently that the kudzu can be plowed in strips and corn grown for one year. Thus the kudzu is allowed to recondition the land—and it will do the job by the end of the growing season provided corn cultivation is not carried too late in the season. Corn yields following such a rotation have been increased fourfold.

It is a good old American custom to try to standardize methods and procedures before sufficient information is available to make them logical or sensible. Three years ago it was thought that all steep lands were unsafe for cultivation. Already the kudzu-corn rotation has proved an exception to this general rule. Undoubtedly we shall find it necessary to modify our ideas as we progress in a soil defense program, but at the moment all evidence points to a more extensive use of sod crops not only on the hill lands to prevent erosion but on the better lands to maintain productivity.

An illustration of what can be expected of sod crops on really good land may be seen in the following: It has been found in Morgan County, Utah, that the returns from irrigated pasture are fully equal to and in many cases exceed those obtained from such cash

and hay crops as peas, cabbage, sugar beets, potatoes, small grain and alfalfa. According to C. R. Richards, the county agent, dairy records in Morgan County show a return of \$100 to \$120 in butterfat production per acre of irrigated pasture. Seventeen pastures lying within the Morgan Soil Conservation District provided grazing for 3½ to 5 animal units per acre for a period of 5 months during the growing season. The usual period of grazing on irrigated pasture in this locality is from May 1 to October 1. At Mount Pleasant, Utah, as much as 1½ tons of hay per acre was cut from some of the pastures, and in addition a considerable amount of late summer and fall grazing was obtained. Pastures used solely for grazing gave approximately the same amount of forage as those at Morgan.

In Circular No. 559 of the U. S. Department of Agriculture, entitled "Review and Discussion of Literature Pertinent to Crop Rotations for Erodible Soils," I attempted to show the advantages of sod in the rotation for soil improvement, and also from the economic standpoint. Additional data are slowly becoming available. In the meantime, we must do our best to encourage soil defense by all possible means, as this is one extremely important phase of National Defense.

THIS COUNTY SUPPORTS ITS DISTRICT

By HARRY B. CARROLL ¹ and FRANK B. HARPER ²



Beardslee and Gleason will lose no more of their precious bottomland to the Wynooche, for this live-willow brush mat put in by the Montesano Soil Conservation Service CCC camp already was doing its job of protecting that land effectively when this picture was taken in the fall of 1940.

GRAYS Harbor County in southwestern Washington is backing its farmers' soil conservation program with dollars. The county commissioners have set aside \$4,800 a year for erosion control and related land-use improvement along streams and on

watersheds. Nor is this all. Through the Montesano-Elma-Oakville Soil Conservation District this Pacific Coast county has made available to landowners the \$162,000 WPA flood control project so that they may have assistance on flood control jobs involving drainage and other work which they plan with the help of Service technicians.

The county's interest in such things as flood control, erosion control and timber crop improvement is not altogether altruistic. County Commissioner Harold Kellogg of Montesano expressed it this way:

"Such work should save tax valuation. Our problem here has been mostly one of soil erosion due to the rapid rise and fall of our streams. We have been very pleased with the work of the Soil Conservation Service CCC-camp in successfully riprapping with live willow brush mats nearly three miles of bank along the Wynooche River, and with the tree planting and other accomplishments. Now we hope that through co-

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Reforestation is the district's answer for some of its timberland problems. Enrollees are here planting Douglas fir seedlings on cut-over, burned-off land, so that a new lot of merchantable timber may be harvested in the future where now nothing but brush and other vegetation grow.

operation of the soil conservation district with other agencies, we can stop the destruction of our farm lands."

The CCC camp, now assigned to the district, began operations in the fall of 1939. The enrollees' initial job consisted of streambank erosion control along the Wynooche and was designed for demonstration purposes. The Wynooche is one of the county's seven major fast-flowing streams. Four years earlier a survey by County Agent Arthur F. Kulin had revealed that 242 acres of Grays Harbor County's best bottomlands had tumbled into its streams in 1935 alone. This soil, for the most part, was carried down into Grays Harbor to aggravate the silting situation that in 5 years' time cost the Government \$3,800,000 for dredging. Grays Harbor is important for lumber, fish and other commercial shipping. As only 1 acre in 10 is tillable bottomland, the 285 acres that were either washed away or covered with gravel in January and February 1935 represented more than 1 percent of the farmers' really good farmland lost forever in the single season. There was mixed comfort in the fact that the average annual streambank erosion damage is but a little more than half as much as it was that year!

Farmers and the county commissioners alike watched closely the work done by Superintendent C. E. McFadden and his CCC enrollees. They drove up the Wynooche after each of the four or five "rises" during the 1939-40 winter and spring. They saw that the willow mats held and started growing where earlier

control efforts had been unsuccessful. In March 1940, the eastern Grays Harbor County landowners, and a few in southwestern Mason County, voted 148 to 2, to form their soil conservation district. It includes more than 300,000 acres of the watersheds of the Chehalis, Wynooche, and Satsop Rivers. Already, farmers in neighboring parts of the county are taking steps toward extension of the district to their areas.

The district's problems and opportunities were by no means limited to the important streambank erosion control, cut-over and burned-over timberland planting, or to pasture improvement and conservation farming practices on the bottoms and gravelly benches—this soon became apparent to the supervisors and to the Soil Conservation Service men they asked in to assist them. They rolled up their sleeves for work—Chairman W. D. Olsan of Satsop, Vice-Chairman Clarence Glenn of Montesano, Secretary H. S. Swenson of Malone, and Supervisors J. H. Taylor of Montesano, and P. S. Austin of Oakville—as did District Conservationist Floyd Otter, Farm Planner F. C. Griffin and Engineer Robert Miller. These are some of the problems they encountered:

Expensive siltation of Grays Harbor at the mouth of the Chehalis River. Decreased soil fertility through leaching by 52 to 86 inches of rainfall a year. Sheet and gully erosion on the logged and burned timbered slopes and the bottoms. Depleted farms with high mortgages, poor drainage, noxious weeds on farms and along county roads and on tax-title lands. Too



Under the district program, drainage, pasture improvement, and other good land-use practices are being developed to produce fertile bottom pasture like this for the area's important dairy industry.

many small-farm units and part-time farmers. Need for more grazing land and the difficulties involved in developing idle logged-off lands for grazing. Inadequate fire protection. Idle and tax-delinquent logged-off lands. Premature cutting of second-growth timber, and cascara bark theft. Difficulties in marketing second-growth timber. The need for summer irrigation—most of the rainfall comes in the winter. Unsatisfactory farm financing. Settlers so scattered that the cost of roads sometimes exceeds the value of the farms they serve. Low production from gravelly bench prairie lands farmed because the fertile bottomlands had been washed away or are unfit through lack of drainage. River pollution from pulp mill waste and sewage, harming the salmon run. Rodent damage to crops. The difficulty of getting clover stands where legumes are required. The need for rural electrification.

Chairman Olsan had reason enough to remark: "I am beginning to see that this soil conservation work we are in is a big thing. At first, I merely wanted to get some work done on these rivers. Now I see that the work we are starting may decide the future of the Grays Harbor country—whether it will be the home of thousands of prosperous people or of a few roving nomads and yapping coyotes."

As the first year of operations draws to a close, the Montesano-Elma-Oakville District's scoreboard does not look so bad, at that:

WPA crews have made much progress in clearing the Wenzell Slough channel of logs and other debris. One of the two farmer "cats" they are using was donated and the other is rented by the county. Soon

the crews will be ready to start similar drainage and bank control work on the Mox Chehalis and on Sherwood Creek. Meanwhile, the county has agreed to do a highway erosion control job by damming an old millrace through which floodwaters of the Chehalis River have been pouring into the Wenzell Slough area. When the Wenzell Slough work is completed, there will be less water on this flat land during the high-water period. This will permit development of 600 acres of some of the richest land in the county, and also more profitable use of the 500 acres or so of fertile pasture and cropland already developed. These figures are significant in a locality where the usual size of a self-sustaining dairy farm is 30 to 60 acres. The farmers themselves will maintain the ditch, fill in old gullies made by flood waters, and carry out approved farming practices on their lands.

The district has helped farmers in the planting of 225,000 trees. In addition, 75,000 trees were planted on approximately 85 acres of the Montesano city watershed, with the city providing \$450 for 50,000 of the Douglas firs and Port Orford cedars. The remainder were furnished by the district from the Soil Conservation Service nursery at Bellingham.

"This plan is part of a dream that I have had for a long time," Mayor J. E. Calder said just before his term expired. "I am proud to have had a part in its fulfillment."

The Elma high school students have bought 200 acres in the district. The land was sold to them for the nominal sum of \$25 by the Mason County Logging Company with the idea of encouraging the permanent school forest project. The district supplied the 7,000

cascara, yellow pine and Douglas fir trees that the senior men, mostly Smith-Hughes agricultural students, planted this spring to start off the 3-year planting program.

In cooperation with the Montesano Chamber of Commerce and the Pomona Grange, the district has agreed to sponsor a fire-protection and reforestation educational program in connection with the 120,000 acres of logged-off timberland on which the Weyerhaeuser Timber Company recently undertook a long-time reforestation and fire-protection program in order to prove the practicability of developing future timber supplies.

The district carries on a definite pasture improvement program, by furnishing seed of uncommon varieties of grasses and legumes for trials made in cooperation with interested farmers.

It is cooperating with the Farm Security Administration so that the farm plans of FSA clients conform with best use of the land, with loans contingent upon proper handling of the land.

Since the district was organized, 120 farmers have worked out complete soil- and moisture-conservation farm plans with the technical assistance of the Soil Conservation Service district staff and that of the CCC camp and including Farm Planner E. E. Rowland, Agronomist Earl A. Lewis and Forester Montague W. Easton who are under the direction of the Tacoma area office headed by Area Conservationist Orlo W. Krauter.

The district has offered timber management and marketing service to farm timber owners, to prevent forest destruction and encourage more orderly and cooperative marketing. This is important especially during the national defense emergency when demands for forest products might lead to destructive cutting for immediate profit.

Recently the district has sought the approval of Army Engineers for flood- and erosion-control work on the Chehalis River, a navigable stream. In the meantime, the soils and conservation surveys being made in connection with the district program are in demand by the county commissioners for making county land classifications and for use in zoning studies.

"There is a lot of valuable land going down our streams to the ocean," Chairman Olsan pointed out, "and we have been clearing poorer land in its place, which in turn goes down the streams. Down there, it has to be dredged at great expense. It is important to learn to take better care of the land we have. We can't treat isolated spots successfully, yet we must

treat everybody alike. This cooperative approach makes for friendship and encourages unit action." He stressed the sheet erosion on hill lands, farms that are too small and the part-time farms, the farmers' flood control problems that are too big for them to handle unaided, and the district's desire to organize a weed-control district and to do something worthwhile in timber marketing.

"If the inhabitants of an area are going to control the community," he added, "they must be self-supporting."

Supervisor Glenn summed it up in these words: "Our major problem here is reforestation, river erosion and soil conservation. I have seen many thousands of acres wash away. It is washing away now faster than it ever did, for the timber is gone and the freshets come quicker. But there is no doubt that something can be done about it through our district."

"We are trying to learn to help ourselves," Supervisor Austin said. "It is not alone a matter of getting government help, but to do it ourselves. It seems to me our organization should be able to step in and give relief to a man who is trying to conserve his soil." Then he added, nodding toward his son standing nearby, "My main interest is in Ted. It doesn't mean so much to me, but I know what he is facing."

C. C. Wade has seen all but four or five of his 21 acres of bottomland—for which he once was offered \$200 an acre—slip into the Wynooche River.

"I never saw anything done on the river that looked as good as this work," he said of the CCC riprapping. "I really believe this will stay; for, as far as that mat has been put in, it hasn't cut a particle. There are not many who have not lost land in this bottom. If something had not been done, the river would have been over here to my barn in another couple of years, taking neighboring land, including the road, with it."

Mr. Wade's neighbors told much the same story. Furthermore, a similar story may be heard also in the western part of Grays Harbor County, along the Pacific Ocean down the Humptulips and Quinault Rivers and landowners in those areas have taken action to petition the State Soil Conservation Committee for permission to join the Montesano-Elma-Oakville District.

With future broadening of territory in view, the supervisors have voted formally that the entire county be given an opportunity to come in with their district. Like the county commissioners, they are interested in the total welfare of a still comparatively new area, the soils, climate, geography and other resources of which mark it as a land of great opportunity for proper agricultural development.



DOWN IN PUERTO RICO

Ready for the take-off: J. J. Stroup; U. S. army pilot (unidentified); G. L. Crawford; Capt. Ramon Guas, U. S. army; G. N. Sparrow, and J. J. Landron.

The Soil Conservation Service in Puerto Rico and the Virgin Islands has been cooperating with the Army and Navy at Borinquen Field. It has been analyzing soils, helping to suppress insects through cooperation of the Insular Bureau of Entomology, and directing the planting of grasses for erosion control on the Post.

The Service has also cooperated at El Morro by supervising the planting of grasses on land where soil had been removed. A survey of Camp Buchanan was made and the sodding of the parade grounds and other areas for the use of soldiers is being supervised.

At Camp Tortuguero the Service is directing the planting of grasses on parade grounds and is working to check the blowing of sand by developing a thick vegetative cover.

At St. Croix, Virgin Islands, the technical staff is assisting the Army by supervising the planting of sod on the shoulders of runways.

Many employees of the Service in Puerto Rico are members of defense committees.

CARTOGRAPHIC DIVISION AND NATIONAL DEFENSE

(Continued from p. 45)

mounting board in such a way that it can be pulled into position and shape while wet.

All of the aerial negatives that have been taken for the Soil Conservation Service in the last 6 years, and all those taken in the eastern part of the country for the Agricultural Adjustment Administration in that time, are stored in Beltsville adjacent to the photographic laboratory, so that immediate photographic printing service is available. During the last 5 months, 48 orders have been filled by the laboratory to meet requests of the War Department. Deliveries have been as follows: 5,020 contact prints; 462 ratio enlargements; 528 index sheets; and uncontrolled mosaics of two areas in Virginia amounting to some 300 square miles.

The rapid method of mapping developed here, many features of which have already been adopted by other departments, is thus far one of the major contributions of the Cartographic Division to National Defense. Materially greater contribution probably will be made if Defense requirements make it desirable to map a large expanse of this country very quickly, for here, in addition to the mechanism for such mapping, we have a force of 170 men trained in this new and highly specialized field. With the equipment on hand, and with the addition of sufficient untrained personnel, working under these men, it is easily possible for this organization to turn out 15,000 to 20,000 square miles per year of large scale planimetric maps. It is in this field that the Cartographic Division can be of maximum benefit to the country.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

HUNGER SIGNS IN CROPS, A SYMPOSIUM. Edited by Gove Hambidge. American Society of Agronomy and National Fertilizer Association. Washington, D. C. May 1941.

A vote of appreciation goes to the two great societies sponsoring the compilation and publication of a volume timely in the extreme as an aid in wartime production of the important crop plants of the United States. A symposium such as this, originating in the laboratories and experimental fields of top experimenters, and edited and arranged by our man of Yearbook fame, Gove Hambidge, is bound to be most useful to farmers and soil conservation technicians. Its subject, nutritional deficiency signs in crop plants, is so close to the health and heart of all of us that interested readers are likely to include not only raisers of field crops, but fruit growers, gardeners, and even the apartment-house dweller with a geranium on the window sill. In a way it seems too bad that the book could not have been extended to include many plants other than crops; yet on the other hand its true objective, soil improvement for better staple crops, is so much a part of soil conservation work that the symposium quickly becomes a valuable key for handy reference wherever soils are used for any one or several of the major crops of the country.

Fourteen authors comprise the symposium, all eminent scientists in the field of experimentation and knowledge having to do with plant growth and the chemistry of soils. Aside from the wealth of authentic information regarding hunger signs in plants, the volume taken as a whole has two outstanding features making it especially valuable to the grower who has no technician at his elbow to act as an interpreter—the language is simple and the approach direct, and the more than 200 illustrations (109 color plates, reproducing both photographs and paintings, and 94 black and white halftones) show starvation signs so clearly as to make them easily identifiable by anyone in the least familiar with garden, field or orchard.

The book starts off with "Why Do Plants Starve?" by George D. Scarseth, soil chemist of Purdue, and Robert M. Salter, Director of the North Carolina Agricultural Experiment Station; thus at the very beginning we find an extraordinarily lucid tabular arrangement showing the raw materials used by plants in growth—if the plants can get them—and approximate equivalents in everyday terms. For example: A "trace" of copper is needed per acre—equivalent to 25 feet of No. 9 copper wire. Again, 50 pounds of magnesium per acre is required by corn for production of 100 bushels—170 pounds of Epsom salt. In "Why Do Plants Starve?" the two authors review separately each of the raw materials used by plants, and also soil acidity intensity, for "a better understanding of what these nutrients do for plants and why plants may starve for lack of them." The elements reviewed are water, oxygen, carbon, nitrogen, potassium, phosphorus, sulfur, magnesium, calcium, iron, manganese, boron, zinc, and copper.

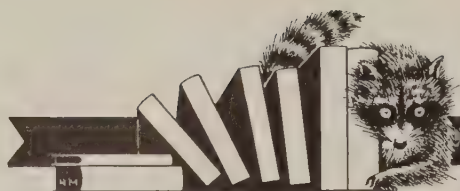
Another excellent feature of this book is its practicality, from beginning to end. Crops are dealt with separately, by authors who are specialists, so that no one of them is slighted as to details of plant-nutrient deficiency, and there is no repetition. Tobacco is

first, with descriptions of plants in different stages of growth and showing symptoms of malnutrition because of the lack of one or more of the elements essential to healthy development. Twelve color plates and eleven halftones are included with this chapter to illustrate hunger signs in tobacco, some of which are often mistaken for disease symptoms.

Deficiency symptoms of corn and small grains are described in one chapter by George N. Hoffer, plant physiologist and specialist in soil improvement methods. He points out the symptoms of nutrient deficiency in plants as the "language" of plants in indicating "the nature of the distress affecting them." He states that corn plants in practically all parts of the United States show symptoms of nitrogen starvation, and that plants weakened by malnutrition are most susceptible to diseases, insects and unfavorable growing weather. In view of the present defense production plan, this chapter is important as an on-the-ground tool in the cornfield, the wheat field, oats, barley, rye, from one end of the country to another. In addition to pointing out visible signs of hunger—yellowish leaves on corn, or leaves streaked or purplish—wheat stunted, with weak stems or too dark a green and deadened tips—the author has included a valuable set of chemical tissue tests consisting of simple directions for testing corn and small grains for nitrates, phosphates and potassium. A full-page photographic chart is included to show what part of the plant is to be tested for each of the raw materials necessary for proper growth and yield. The farmer need not be a chemist to perform these tissue tests; the author is of the opinion that no grower of corn can afford to neglect supplying himself with the materials for making the simple test for nitrates.

The subject, plant-nutrient deficiency symptoms in the potato, is treated by H. A. Jones and B. E. Brown, both of the Division of Fruit and Vegetable Crops, Bureau of Plant Industry. The "cotton chapter" is by H. P. Cooper, director of South Carolina Agricultural College, and here the treatment is slightly different in that other raw materials enter the picture and the approach is somewhat more technical. "Plant-Nutrient Deficiencies in Vegetable or Truck-Crop Plants," by J. J. Skinner of the Bureau of Plant Industry, is a long chapter including 14 halftones and 11 color plates showing in truly lifelike manner those danger signs in garden peas, cabbage, tomato, lettuce, turnip, squash, cucumber, radish, beans, cauliflower, and onion, which are so familiar to vegetable growers and amateur gardeners. Some useful notes on truck-crop soils and corrections of plantfood deficiencies are given at the end of the chapter.

Nutrient deficiency symptoms in deciduous fruits, by O. W. Davidson, biochemist in horticulture at the New Jersey Experiment Station, is a long chapter treating chiefly apple trees, peach, and strawberries, and including 13 color reproductions of paintings by Mary E. Eaton. It is written in a lucid style and is of a type in other ways to be used by growers without the aid of technicians. Citrus fruit malnutrition symptoms are described separately by four specialists, A. F. Camp, horticulturist of Florida; H. D. Chapman, agricultural chemist of California; George M. Bahrt, soil technologist of the United States Department of Agriculture; and E. R. Parker of the Citrus Experiment Station, University of California.



BOOK REVIEWS AND ABSTRACTS

continued

The chapter on plant-nutrient deficiency symptoms in legumes, by E. E. DeTurk, soil fertility expert of the University of Illinois, will likely prove most interesting to Soil Conservation Service technicians and thousands of cooperating farmers, because of the nitrogen-fixation ability of these plants and their extensive use in soil conservation programs. It appears that the very nature of the legumes sets them in a class apart in the matter of easily identifiable hunger signs—the author points to potassium as “the one common element a deficiency of which is shown by easily recognizable symptoms that are well known because of their common occurrence in a wide variety of legume crops.” Pointed out also is the fact that the problem of soil acidity is definitely related to nitrogen nutrition of legumes, and the author discusses the problem in its relation to the calcium requirements of the leguminous crops. Apparently, much remains to be learned about the nutrient deficiencies of legumes, and some interesting problems for study are pointed out in this article.

Each of the articles of the symposium includes a selected reference list, not extensive, but “choice.” Likewise, keys for quickly identifying a deficiency by its symptoms are given in the chapters dealing with hunger signs of tobacco, potato, cotton, tomato, deciduous fruit trees and citrus trees.

DEFENSE—ONE YEAR. Office of Emergency Management. Superintendent of Documents, Washington, D. C. June 1941.

The year just passed has been ten years long to a United States anxious and determined to “get going.” Nowhere have we seen the figures that might represent even remotely the loss and expenditure of human power and efficiency through the individual and collective anxieties of the twelve months just gone. Such figures

can never be compiled, of course, and the losses will best be forgotten; but much can be done to erase the worry of waiting—read “Defense—One Year” and learn the actual facts about the tremendous ramifications of building for defense, and then—look forward and upward. Much delaying criticism can be avoided by a people well informed in a time of emergency.

In this, their first yearly report, the OEM gives us the facts and the figures. They want us to know what we are paying for our great armament-for-defense program, what has been done and is to be done about getting the essential raw materials, what the defense housing program consists of, the meaning of and the reason for subcontracting, and what lies ahead in the way of doubling, trebling, quadrupling, fivefold the monthly output of machines and munitions.

We are informed here of payments already made, contracts on order, and appropriations for future expenditure for naval ships and aircraft, ordnance, bases and stations and fortifications, industrial facilities, equipment and materials and construction, pay rolls. For purposes of aiding our government by informing others, and purposes of morale, it is important that we know the facts.

The facts about the building of plants for war-time production, and getting the raw materials to feed those plants and the skill to man them, may be pointed to as evidence that the “first year is the hardest.” Likewise, after studying this report we realize that the Defense Program has not merely grown of itself, Topsy-like. Purpose is clearly apparent in the organizational procedures behind the tremendous production movement now in full swing. The OEM's report is not a propaganda paper in any sense of the word; it is a simple statement of the facts as to what has been done, is being done now, and will be done in the next twelve months, in the way of actual and tangible supplies and armaments, to safeguard our country from dangers real and threatening.



Toulouse geese, Dorset sheep, and Berkshire hogs in Harford County, Md.

As our defense efforts progress, the demands for labor-saving devices on farms are sure to increase. Farmers have been called upon to augment the supply of meat and dairy products for Great Britain. Good pastures are tops in reducing the labor and other expenses involved in producing livestock. Several classes of livestock that we cannot keep together in the barn or feedlot can be grazed on the same pasture very satisfactorily. At the same time our soil is definitely safe from attack by its enemies as long as a productive sod is kept growing on it.

Excerpts from recent addresses by Honorable Claude R. Wickard Secretary of Agriculture

Overshadowing everything is the world crisis. The times through which we are passing will decide what kind of a future the United States will have. We are determining whether we intend to remain a great democracy, and perhaps a great world power . . .

There is no sense in producing for delivery at the bottom of the ocean . . .

I don't think the American people want to live in a world run by the Nazis. I don't think they intend to live in a world run by the Nazis. A world run by the Nazis means the destruction of freedom and democracy in the United States. We'll do whatever is necessary, to protect our freedom and our democracy . . .

So far as organization is concerned, farmers are in far better shape today to meet the economic consequences of war than they were in the First World War. It was then that the Extension Service and vocational education were born. All of agriculture's service organizations, including the cooperatives, have seen their greatest growth in the years since that war. Newer agencies in the Department of Agriculture—the Triple-A, Soil Conservation Service, the Farm Security, Surplus Marketing and Rural Electrification Administrations—have all placed additional emphasis in recent years on the administration of farm programs by farmers themselves. Now that war is once again aflame in the world, farmers are looking to these very agencies—both government and non-government—to help them avoid the economic pitfalls which lie ahead . . .

Our first line of defense is a well-fed, healthy people on the home front . . .

What will happen to the farmer after the war will depend entirely on who wins the war, and how well the farmer is prepared to cope with problems as serious as any that have yet confronted him. To prepare properly, we are going to have to face the future realistically. We are going to have to be prepared to see our export markets drastically reduced, and then devise means of building them up again. We are going to have to produce more food and feed for home use in the export crop areas. And last, but far from least, we are going to have to guard against the depletion and destruction of our soil that took place in the First World War. Farmers can best combat these obstacles by working together, by using their programs, by thinking ahead . . .

If the United States acts quickly enough and effectively enough the striking force of this country and of the British Empire can check Hitler. If we are too late, the striking force of the rest of the world, under Hitler domination, is likely to converge on us . . .

For months now, I have had the feeling that a large part of the world will be starving after this war is over. Many countries will be looking to the United States for food and they'll really listen to what we have to say if we can feed them. I've got a pet statement that I've made a good many times—"Food may not only win the war. It may decide the peace too." . . .

As soon as possible, we ought to build up reserves of almost every vital food. I am not worried about not being able to use it . . .

After this emergency is over, perhaps the world will be ready to look at international trade in raw materials in a more sensible way than it has in the past. The struggle to give away wheat, cotton, and other real wealth is just as senseless as world wars . . .

CONTENTS

	Page
Zero to Thirty Million Mile-a-Minute Seedlings: By Paul Tabor and Arthur W. Susott.....	61
Bankers Put Cash Value on Conservation Program: By A. E. McClymonds.....	65
Wanted: Technical Assistance Only: By F. E. Charles.....	66
Land and People: By H. H. Bennett.....	71
Erosion Control for Reservoir Protection: By Harry E. Reddick.....	77
Footprints in His Fields: By William C. Pryor.....	80
Terraces and Neighborliness—All Within a Day: By Arthur W. Susott.....	82
Rains on the Plains: By L. L. Harrold.....	85
Suggestions for Pasture Mixtures. (I. North- eastern States).....	87
Book Reviews and Abstracts: By Phoebe O'Neill Faris.....	88
For Reference: Compiled by Etta G. Rogers.....	Opposite 88
Front and Back Covers (<i>blue grama</i>), by C. E. Margraff	

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

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Thousands of kudzu seedlings for erosion control in the Southeast. An aerial photograph of part of the Soil Conservation Service nursery at Rock Hill, S. C.

Zero to Thirty Million Mile-a-Minute Seedlings

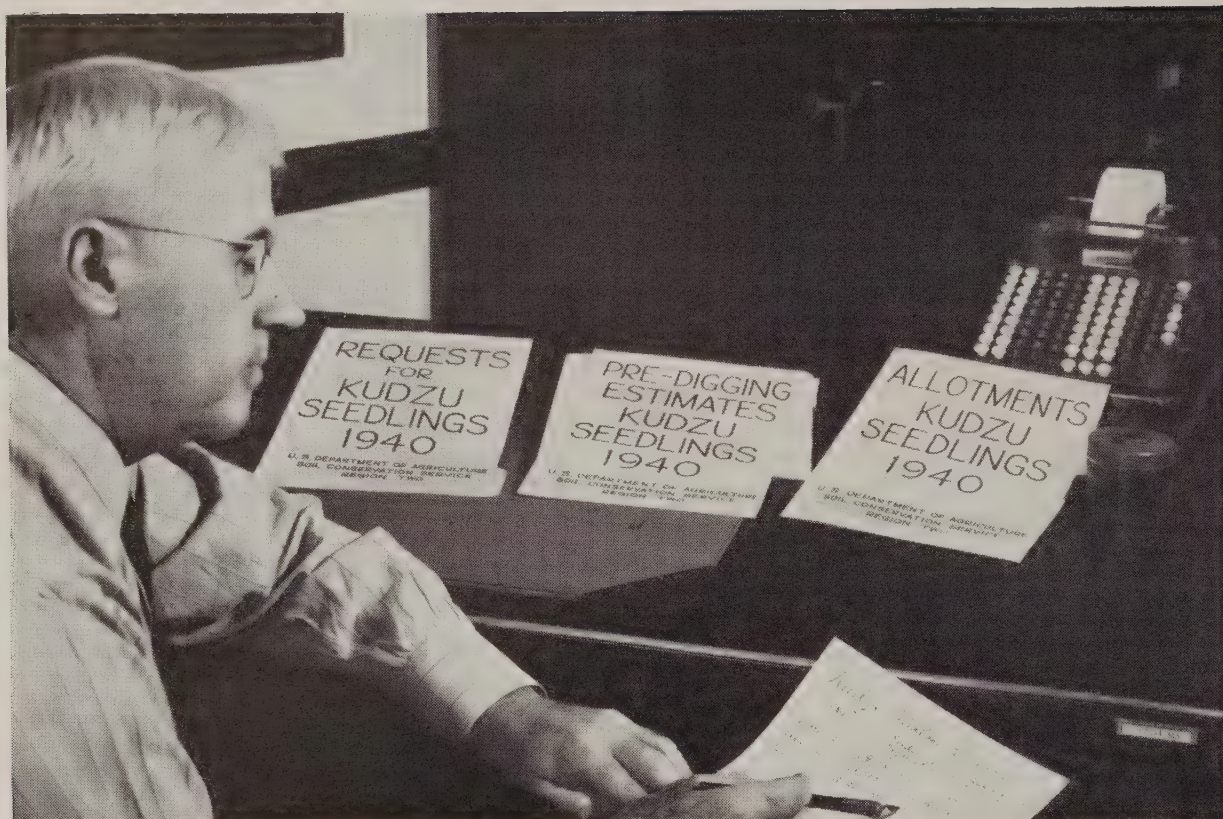
By PAUL TABOR and ARTHUR W. SUSOTT¹

TODAY, Soil Conservation Service nurseries in the Southeast produce millions of kudzu seedlings annually. These are distributed in limited quantities among farmers cooperating with soil conservation districts so that they can establish good beginning stands of kudzu. Once a good stand is established the crowns can be used in expanding acreages.

Trial plantings under varied conditions and constant observation and study during the past few years have enabled personnel of the Service nurseries to improve methods of growing seedlings, and thereby speed up production. Commercial growers also grow far more seedlings and hundreds of farmers have found it profitable to sell crowns from the stands of kudzu they have established.

Generally speaking, kudzu's chief use in the Southeast back in 1934 was as a shade or ornamental plant

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During November, L. B. Scott, chief of the Service's southeastern regional nursery division, figures out the distribution to be made of kudzu seedlings. By that time predigging estimates have given Mr. Scott a good idea of the size of the current seedling crop. Allotments are based on the size of the seedling crop and the number of requests for seedlings. Area and district conservationists of the Service supervise the distribution to farmers in soil conservation districts.

around the home. Soil Conservation Service workers were certain, however, that kudzu had a definite place on the southeastern farm. They knew it would check erosion, even on badly eroded steep land, and once established would provide the farmer with a dependable source of first-class hay. Within the short span of 6 years, southeastern farmers have developed a genuine appreciation of kudzu and Service nurseries have made noteworthy progress in meeting the farmer demand for seedlings.

In many sections of the Southeast, farmers now call kudzu the "porch," "mile-a-minute," or "telephone" vine, or the "thunder 'n lightning" plant. Many Negro farmers just refer to it as "the vine." Kudzu runners often grow 50 feet long in a single season.

An idea of the widespread farmer acceptance of kudzu can be gained from the number of seedlings distributed by Soil Conservation Service nurseries during the past 6 years. This past planting season the nurseries supplied more than 30 million seedlings to farmers in 82 soil conservation districts in the Southeast—enough to plant 60,000 acres. The previous year 23 million seedlings were produced, and in 1938 a total of 13 million. During 1937, the nurseries raised 4½ million, but none at all in 1936 as seed could not be obtained. A total of 600,000 seedlings were grown dur-

ing 1935. All told, more than 73 million seedlings have been produced by the nurseries during the past 6 years.

During the past planting season—January to April—the demand for kudzu seedlings was so heavy that by February most commercial nurseries and private growers reported their seedlings "sold out." Many farmers, however, expanded their kudzu acreage by planting crowns dug from kudzu stands already established; or if they did not have stands, they bought crowns from neighbors. Some farmers realized as high as \$100 an acre from the sale of crowns which sold at \$5 to \$7 per thousand.

In spite of increased production by Service nurseries, greater output by commercial nurseries and private growers, and the number of crowns that can be dug from established stands of kudzu, there appears to be no immediate probability of reaching the saturation point in seedling production. Too many acres of eroded farm land in the Southeast still are badly in need of permanent vegetation such as kudzu. Moreover, there are thousands of farms that would benefit by including kudzu in the cropping system to provide an additional source of hay or forage. Raising enough feed for livestock is still a serious problem on many farms in the Southeast.

As a matter of fact it would require years to produce sufficient seedlings for all the farm land in the Southeast that might be suitably and advantageously planted to kudzu. The magnitude of such an undertaking looms more clearly if considered from the standpoint of a fraction of the job ahead in soil conservation districts in the Southeast. These districts have a total land area of approximately 100 million acres, and more are being organized. Presuming that Service nurseries continue to produce enough seedlings to plant 60,000 acres annually it will require almost 14 years to grow enough seedlings to plant one out of every 100 acres in the districts already organized.

As it turns out, however, the job of the Soil Conservation Service nurseries is not merely a matter of producing seedlings sufficient for planting 1 or 2 acres out of every 100 acres in districts. The complete conservation plans being developed for farms in most of the districts call for more. Even on small-sized farms—say about 40 acres—the conservation plan often provides 4 or 5 acres of kudzu.



After kudzu seedlings have been pulled from ground, they are graded and tied into bundles of 25 each. Loose root ends have been trimmed from the two bundles held by the CCC enrollee, at right, to facilitate planting.

The total production of 73,300,000 seedlings by Service nurseries was sufficient for planting 146,600 acres, although not all of the plants survived. Today, survival is much better, as techniques for planting and care have been improved and farmers are showing a greater interest in obtaining good stands of kudzu and maintaining them. R. Y. Bailey, regional agronomist of the Soil Conservation Service, estimates that approximately 120,000 acres of kudzu have been established in demonstration areas and districts from seedlings supplied by the nurseries. In addition, many more acres of kudzu were established, with seedlings obtained from private growers or with crowns.



Weeds are carefully removed from young seedlings in Service nurseries, to insure rapid and healthy growth.

It is significant to note that of the 120,000 acres established, 60,000 acres, nearly half the total, were planted the spring of 1941. This reflects the constant increase in the demand for seedlings and the steps taken to meet this demand. In Clay County, Ala., farmers cooperating with the SCS-CCC-camp demonstration program planted 2,600 acres during the past 5 years. This past year the farmers in Clay County were scheduled to plant 3,000 acres as part of the conservation program of the Piedmont Soil Conservation District, which embraces Clay County. Here and there throughout the Southeast similar increases are reported.

Along with the steady increase in nursery seedling production, improvement in the technique of producing the seedlings has been noteworthy. Six years ago the immediate problem at hand was to produce kudzu seedlings in large quantities so that kudzu could do a good job of controlling erosion and producing forage that is sorely needed in the Southeast. Crowns of kudzu plants could be utilized, but they could not be produced in large quantities as readily as seedlings. Vine cuttings had been tried, but this method was not entirely satisfactory. It was apparent that kudzu seed was needed.

Approximately 350 pounds of seed were obtained from Japan for sowing during 1935 in trial plantings on a nursery plot at the Dadeville, Ala., demonstration project and at Service nurseries at Fairhope and Atmore in the same State. The seed produced 600,000 seedlings which were transplanted on farms in erosion-control demonstration areas with good results. More seedlings were requested by farmers for the next planting season, but in 1936 no seed could be obtained. However, seed from Japan became available again for the 1937 planting season and 4½ million seedlings

were produced. In the succeeding years more and more seed was bought from Japan for nursery use.

Visitors to the Soil Conservation Service nurseries frequently ask why the nurseries do not produce their own seed. At present, it is explained, the nurseries find it less expensive to buy seed from Japan, where climatic conditions are more favorable for the production of good viable seed in large quantities. Then, too, considerable experimental work remains to be done in the Southeast before satisfactory methods of seed production can be developed. One requirement for growing seed seems to be that kudzu must grow upright. Seed pods seldom appear on kudzu growing flat on the ground in open fields, but plants growing upright in gullies or climbing on small trees or bushes have a tendency to produce seed.

Service nurseries are not overlooking the possibilities of local seed production, especially in view of the present uncertainty of foreign sources. Experiments in which the Bureau of Plant Industry is assisting are under way at the Soil Conservation Service nurseries at Rock Hill, S. C., and Thorsby, Ala. Climate is among the various factors that has to be considered, as moisture conditions during the growing season seem to have considerable influence on the quantity of seed produced. Observations indicate that more seed is produced during summers having more than average rainfall. Methods of storing seed to ensure greater viability also are being studied at the nurseries.

The seed for seedling production is treated carefully to ensure good germination. Kudzu seeds have thick, impervious coats, but after going through scarifying machines they absorb ground moisture easily after planting. Tests were begun in 1940, in cooperation with the Bureau of Plant Industry, with hormone material and decay-preventing dusts, to develop treatments to help stimulate early growth of seedlings and protect weak seeds against decay.

As a result of field trials and improvement in methods of growing seedlings, the seeding rate at the nurseries has been reduced until now only 12 to 15 pounds are planted to an acre. During early operation of the nurseries the rate of seeding ran as high as 100 pounds an acre. Under favorable growing conditions, a good stand of young kudzu seeded at the rate of 12 to 15 pounds an acre will produce 100,000 seedlings an acre.

May and June appear to be the best months for planting the seed. The average daily temperature should be above 65° F., and the soil moist. Lack of moisture often results in poor stands, and for that reason practically all of the seed is planted before July. Soils in

the Southeast have plenty of the proper bacteria, so that the seed does not require artificial inoculation.

The seedlings can be grown in either narrow or wide rows. For most part those in the nurseries are grown in uniformly spaced pairs of double rows to facilitate cultivation and use of the machinery that lifts the plants when they are ready for transplanting. The double rows are 8 to 10 inches apart and the middle between the double rows about 20 inches. On each side of two sets of double rows are wider middles—30 to 34 inches—which serve as pathways for the wheels of tractors and lifting machinery.

Trials and experience at the nurseries have shown that satisfactory seedlings can be produced without commercial fertilizers on soils with mineral content sufficient to produce 25 or more bushels of corn per acre. On poorer soils a complete fertilizer is needed. Weeds easily stunt the growth of young plants, and frequent cultivation is necessary. When plants have suffered seriously from stunting, side dressings of commercial fertilizer are applied.

The seedlings are not removed from the nursery beds until they are dormant. An extended drought may induce dormancy before the vines are killed by cold weather, but even so it is best to wait until the vines are dead and thoroughly dry. The job of removing the seedlings has to be done carefully so that as few as possible of the plants are split or broken. The first step is to cut away the excessive vine growth; then a lifting machine with a strong sharp blade is run about 10 inches beneath the rows to cut the roots at a safe depth and loosen the soil. The plants are then carefully pulled out by hand, graded, and tied into bundles of 25 each.

The life of a kudzu seedling after it is removed from the nursery bed depends greatly on the quantity of plant food stored in its roots. For this reason only those seedlings with one or more roots as large as an ordinary lead pencil are selected as suitable for transplanting. The split or badly bruised seedlings are given time to heal before being regraded.

The seedlings, after they are lifted from the nursery, are stored at various SCS-CCC camps in the southeastern region of the Service so that distribution to farmers in soil conservation districts can be handled with ease and efficiency. At CCC camps the seedlings are "heeled in" in well-drained trenches: sand is packed firmly around the plants and more is added on top to form a protective covering at least 6 inches thick. Further protection against cold weather is provided by placing pine needles, pine brush, or roofing material on top of the trenches. During February and

March the seedlings are distributed from the CCC camps to farmers cooperating with soil conservation districts. Planting on the farms is completed during March and April.

Six years ago fields of kudzu were few and far between in the Southeast, but today this plant is no longer a stranger on the farm. In addition to the 120,000 acres established in districts and demonstration areas from seedlings supplied by the Soil Conservation Service nurseries, the region has hundreds of other good stands that have been established during the past 6 years—many of them the direct result of farmers' visits to demonstration areas.

In the beginning, many farmers were skeptical about kudzu, as it was relatively new to them. Among the stories they had heard was that kudzu might become a pest difficult to control and that harvesting hay was quite a laborious and complicated task. Technicians assisting in the demonstrations pointed out that kudzu can easily be eradicated by overgrazing; and harvesting demonstrations have shown that by the use of a simple attachment on the mowing machine cutter bar, kudzu is easy to cut as hay in spite of its viney growth. Today, kudzu is seldom regarded as a pest, and farmers are taking care against overgrazing.

Farmers have learned also that with proper care and attention kudzu will thrive on badly eroded or waste land. As a feed for livestock, kudzu is highly palatable and ranks with alfalfa in nutrient value. During periods of drought when pastures fail, a field of kudzu serves admirably as a temporary pasture.

Experience of southeastern farmers shows that kudzu is an excellent crop for increasing soil fertility. In field experiments in Alabama kudzu increased the yields of corn approximately 20 bushels an acre on land that in most instances had been abandoned for cultivation. Agronomists of the Soil Conservation Service predict that kudzu will be used in rotations on millions of acres of badly eroded cropland.

The prospects of obtaining more seed from Japan or other foreign sources have been dimmed somewhat by recent world events. Even so, should seed become scarce, the Southeast now has thousands of acres of well-established kudzu from which farmers can obtain crowns for use as planting stock. Meantime, as work of the Service nurseries and other plant growers progresses it is not unlikely that ways and means may be worked out in this region for the local production of seed in large quantities.

BANKERS PUT CASH VALUE ON CONSERVATION PROGRAM

By A. E. McClymonds¹

NEBRASKA mortgage bankers have put a cash value on soil and moisture conservation—a substantial value that maintains nearly identical ratios on the more valuable lands and those of lower value.

This is important, since most of us are prone to judge the worth of many things on the basis of whether or not we can afford them. The implication of the bankers' appraisal is that a farmer cannot afford to be without a good conservation program.

Representatives of the Nebraska Mortgage Bankers' Association made the appraisal late in May during the course of their annual meeting at Lincoln, when the members made a tour to Pawnee City, headquarters of the Turkey Creek Soil Conservation District.² They were armed with land-use capability maps based on the physical conditions of the soil, slope, and erosion, which had been prepared by Soil Conservation Service technicians.

The appraisers evaluated two 160-acre farms, across the road from each other. One, Frank Kalina's, has planned for it a complete conservation program, and some of the practices already are established. The other, Frank Mort's, is without a conservation program.

On the basis of similar places, the bankers set the present sale value of Kalina's farm at \$4,800; without the conservation program they would have put the figure at slightly under \$3,200. They estimated the present sale value of Mort's place at slightly less than \$2,000, and concluded that the addition of conservation practices would raise this by \$760.

Loan value appraisals are particularly interesting.

The bankers set the loan value of Kalina's farm, if without conservation practices, at \$691 and decided that after 10 years of farming without a conservation program this figure would drop more than a third—to \$410 by 1951. As it is, they placed the present loan value at \$2,200, and the 1951 loan value at \$2,450 if the conservation program is continued.

¹ Regional conservator, Northern Great Plains Region, Soil Conservation Service, Lincoln, Nebr.

² See *Of the Farmers, By the Farmers and For the Farmers*, by A. E. McClymonds. SOIL CONSERVATION, February-March, 1941.

They placed the present loan value of the Mort farm at \$229 and estimated this would drop to \$133 by 1951 as a result of nonconservation operations during the intervening decade. On the other hand, the appraisers decided that if Mort had a conservation plan in operation the present loan value would be \$670, with an increase by 1951, after 10 years of conservation practices, to \$975.

Aside from evaluating the Kalina farm on the basis of conservation and nonconservation operations, some of the bankers also expressed their opinions on the human element. These men said they would feel justified in lending more on the farm if Kalina stayed there than if he moved away so that the prospect would involve less permanency of occupancy and operators. Stabilizing people on the land is important, too, is their view.

Before the appraisers went out on the job, the association heard speakers from the Nebraska College of Agriculture, the Extension Service, and the Soil Conservation Service; and they had gone on a tour to see some of the work that had been done. Thus the men selected for the appraisal had a clear idea of what the various conservation practices are doing in the

way of stabilizing and even raising the productivity of farm lands. Productivity is, after all, the security for the loans offered by the association members.

This appraisal by disinterested persons of the job the United States Department of Agriculture has undertaken—the job of helping farmers to get on a firm footing and to stay there—is significant, particularly in view of the fact that a strong agriculture is the backbone of national defense at all times.

The farmers of Pawnee County, for the most part, are livestock feeders who derive their principal income from cattle and hogs, staple commodities that are especially in demand in these troublous times. By maintaining their credit base—and the bankers' appraisal indicates that they feel that conservation practices help to do this—the farmers are in a position to produce more and better crops and stock for the welfare of the Nation.

Substantiating the judgment of the appraisers, representatives of five insurance companies went to the Turkey Creek Soil Conservation District office to ask about conservation practices and how to apply them on lands their companies have had to take over. They, too, wish to protect assets.

Wanted: Technical Assistance Only

By F. E. Charles

WHOEVER wrote the "rain in cherry blossom lane" song must sometime have been in Michigan's famous cherry country—in beautiful Leelanau County, "land of delight," in Indian language—or in Grand Traverse County where the tourist business vies for leadership with fruit culture.

Interwoven with the story of this land of sweet and sour cherries is the story of how farms bordering picturesque Grand Traverse Bay have lost their soil—and how landowners there now have learned to hold it. The countryside is idyllic. In winter, snow settles over the landscape. When spring breaks, cherry trees covering hill and vale blossom in banks of pink and white. When summer slips in on southerly breezes, the undulating hills turn crimson, as farmers direct small hordes of migratory "pickers" to the harvest.

Only a few years ago these Michigan cherry farmers were clean-cultivating their orchards. They thought they had to. Like the Corn Belt farmer who took pride in straight rows, here, too, neighbors envied the

man who could say "There isn't a weed in my orchard."

Then, abruptly they changed their system. Their steep, sandy, erodible soils now lie most of the time beneath blankets of green cover.

In 1936, only 131 acres of cover crops were grown in all Grand Traverse County. During the next couple of years farmers began to revise their thinking: Records for 1939 show 3,866 acres of cover; 10,000 acres a year later; 7,000 acres, a "very conservative" estimate according to County Agent Carl Hemstreet, actually were seeded in orchards and fields within the year.

A combination of reasons accounts for this increased use of cover crops. Carl Hemstreet has advocated soil-building practices since 1935. The Triple-A program resulted in more cover and green-manure crops. Land taken out of production was sown to meadow—thousands of acres to that magnificent Michigan combination of alfalfa and brome grass.

It was in March 1936 that Hemstreet first called together twenty-odd members of his county land-use planning committee. Among other things regarded as essential by these leading farmers was control of soil erosion. They thought some intelligent land-use planning was needed, but they didn't think such planning was practical without basic information on all lands within the county. Such data were obtained in a survey made by J. O. Veatch of Michigan State College,



Proof that the wind sweeps the sandy soil from exposed areas, uncovering the roots of heavy investments, cherry trees.

giving these Grand Traverse farmers a chance to divide their land into areas suitable to agriculture, forestry, and recreational purposes.

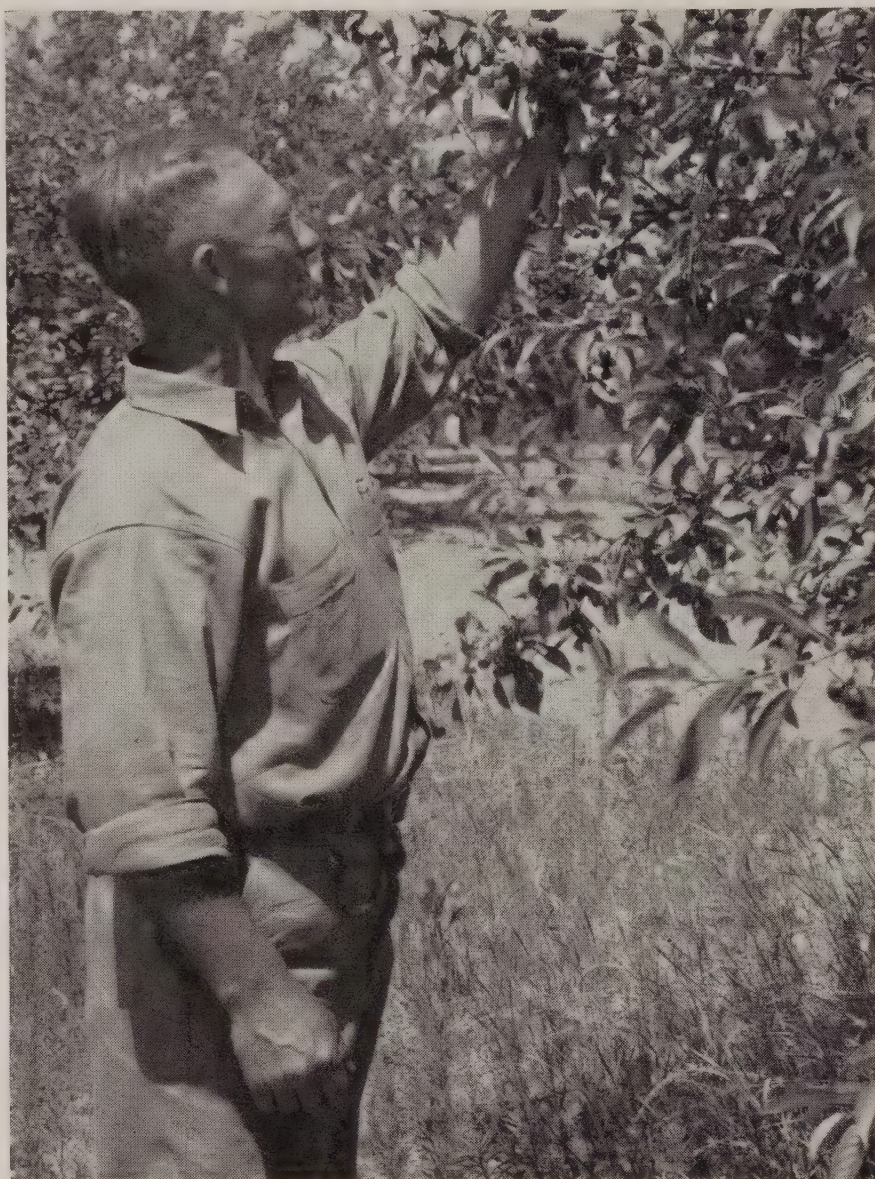
The survey, and subsequent study of the data by intelligent farmers, emphasized the fact that Grand Traverse was losing a lot of its best topsoil. Cover

crops were advocated as one remedy.

Another factor was something the county land-use committee had to work to get—a soil erosion control demonstration area of the United States Department of Agriculture. Grand Traverse farmers had been hearing about such an area in the Benton Harbor fruit



This is the sort of landscape to be reforested by the South Muskegon soil conservation district. Studying this example of cutting are Carl Knopf, county agent; Vic Anderson, secretary-treasurer of the district directors; William S. Ufer, district conservationist, and Olaf Hostad, chairman of district directors.



Roy Hooper is chairman of the county agricultural planning committee at Grand Traverse. None fights harder for community cooperation, and none grows finer cherries.

section and another near Howell. But these areas were 200 miles down-State—farmers could not see the demonstrations at that distance. They petitioned the Secretary of Agriculture to set up erosion-control demonstrations somewhere in the upper end of the lower peninsula. That was in the winter of 1938-39. By spring of 1939 the Soil Conservation Service made available to them two trained soil-conservation farm planners. Three areas in Grand Traverse County were selected as "typical" of erosion problems in that end of the peninsula.

One was the Acme area, lying east of Grand Traverse Bay, where farmers are gradually shifting from general farming to fruit. A second area chosen for demonstrations was the Old Mission Peninsula which juts into Traverse Bay and is richly endowed with

soil and climate suitable to cherry growing. A third area of more general farming lies farther inland, in the southwestern corner of the county.

When seeking assistance in planning their farms for soil conservation, these farmers made it plain that they were not asking for donations of materials and labor. They asked only for guidance. Guidance is what they got and they have followed it to the letter. Even as recently as 1939, many Grand Traverse orchards were cultivated "clean as a whistle"—Peninsula Township does not look like the same place now, the orchards are so completely protected with alternate middles of sweetclover and Sudan grass.

Lee Rosencrans, head man for the soil-conservation project, took me all over the peninsula. We stopped and talked with farmers, saw diversion terraces, new



Look at the size of the sweetclover grown by Clyde Morrison in his orchards. The clover serves as green cover, can be cut for hay or silage, may be harvested and used as mulch, or may be disked into the ground where it stands.

orchards planted on the contour, sod waterways, alternate sod middles, farmer-built contour furrows in pastures, marl being spread, and peat being scattered for mulch in orchards.

New diversion terraces have been built on the Van Cleve farm, managed by Dave Murray. Sweetclover, bluegrass and rye, early fall seeded, have covered that washy soil. On Murray's own farm he has built diversion terraces, a farm roadway—and has seeded and sodded the roadside ditches to avoid washing.

"Who built the terraces?" I asked Rosencrans.

"The farmers did. They say to us, 'Show us where to put it and we'll build it.'"

Murray's orchards are green with alternate sod middles. His neighbor, Bert Kroupa, has set a new

cherry orchard on the contour. Now he is planning two adjoining tracts for contouring. We stopped at the roadside to talk with Oakley Lardie, young fruitman and Tripple-A checker. "Yes, a lot of them are taking to conservation, especially sod waterways and alternate sod middles," he remarked.

Where the farms of Mrs. Nellie L. Bostwick and Francis H. Hughes join up, you can walk entirely across the peninsula from East Bay to West Bay and never be out of orchards protected with alternate sod middles or complete sod mulch.

There are steep slopes on some of those Old Mission sand dunes, as steep as 45 percent. Soil conservationists would rather not see fruit trees planted on them at all. Yet, sometimes the owners feel that they must

(Continued on p. 79)



A. Erosion on $3\frac{1}{2}$ -percent slope, Houston black clay, typical black clay land of Texas Black Belt; on unprotected field with rows running downhill. Note cotton covered up at foot of slope and enormous amount of soil washed out of fields as result of early summer rains. Near Mesquite, Tex.

B. In contrast to A, there is little erosion here under strip cropping on same kind of land.



Land and People

By H. H. Bennett¹

THE FIRST big surprise of the trip came at the soil conservation meeting at Red Oak, Iowa. It was one of a number of similar meetings held in Iowa during *Soil Conservation Week*, June 2 to 7, inclusive, proclaimed by Governor Wilson for the State. Here at Red Oak, it was announced that in this region of straight-line plowing *fully half of all this year's corn in this typical Corn Belt County of Montgomery had been planted on the contour*. Four years ago, I was told, not an acre of corn was grown on the contour in that county.

This mass action on the part of farmers of Montgomery County, west-central Iowa, afforded the kind of surprise that makes soil and water conservationists feel good all the way through. It called to my mind what Secretary Henry Wallace said to me one day in 1936 after listening to some of my complaints about the slowness with which Plains' farmers were taking hold of our proved methods for controlling dust storms. He came back in reassuring words to the effect that we needn't be too discouraged about it, because, according to his observation, it often takes farmers around 6 or 7 years to begin to adopt new agricultural practices on a large scale, even after seeing them in effective operation.

Elsewhere in Iowa, I saw occasional fields with corn planted on the contour, and here and there some strip cropping and terracing—not a great deal but enough to show that 7 years of work in Iowa is beginning to get results. I saw some of those things along the same highway I traveled as I crossed the eastern part of the State in 1939, although 2 years ago I did not see a single contoured field or a single field in which any real soil conservation measure was in use.

New light on the value of soil conservation to farmers.—We visited F. E. Confer's farm near Red Oak, where we saw a completed job of *total soil conservation* covering the entire farm, in which some 10 different measures had been applied to meet the needs and the adaptabilities of the various kinds of land on the farm. Afterward someone asked the owner what value he placed on his farm now as compared with the value before treatment.

"Well," Mr. Confer replied, "I am satisfied with the erosion-control work. I have been living here on the farm about 35 years. I hope to continue living here with my son and his children. I think we can and will do just that. We look upon this farm as a place

to live and make a living. We are not thinking of selling and haven't a price on the place."

That was a mighty good answer. A good farm, if you keep it good—and you can, with proper conservation practices—is a good place to live. It is a basis for "a way of life." Some people will want more definite information, and here are some figures that may be helpful in getting a slant at the dollar angle:

The Confer farm is a typical Missouri Valley loess farm and, like all other farms on this kind of land, is subject to impoverishing erosion where not adequately protected. It is quite representative of the average of 132 farms recently studied with respect to net income. About half of these had been treated with soil conservation measures in the West Tarkio soil and water conservation demonstration project,² established under the Soil Conservation Service program in 1934. Records kept on these farms show that the average net income was \$366 and \$348 *greater per farm on the conservation-treated farms than on the same kind of Missouri Valley loess land without conservation practices*. Those figures were for 1939 and 1940, respectively.

*I saw flood control operating at McGregor.*³—At Decorah in Winneshiek County, Iowa, we got an eyeful of what unleashed rainfall can do to land and property and people. We were met a few miles outside town by a number of prominent citizens interested in agricultural matters, and were taken immediately on a tour to see how things had stood up under the impact of 7 inches of rain that had fallen in about 2 hours, a week before. The damages in the county were roughly estimated as follows:

1. Cost of taking silt out of the cellars and off the streets of Decorah, including damage to buildings and other property.....	\$200,000
2. Repairs to two railroads, neither of which had operated a train since the flood, and had more than an additional week's work to do before trains could be run.....	400,000
3. Damage to county highway system—bridges washed out and damaged, roadways damaged.....	300,000
4. Soil erosion—direct damage to land.....	500,000
Total (partial).....	1,400,000

Gullied and sheet-washed fields, lower slopes covered with debris (rich soil washed from fields up-slope), corn covered or washed out, and alluvial lands gouged out, all made up a dismal picture, especially in view of our full understanding of the richness of these northeastern Iowa farm lands.

² See *Withstanding a Test That Comes Once in a Century*. By R. H. Musser, SOIL CONSERVATION, August 1937.

³ See *Defense—From Ridge to River*. By L. R. Combs. SOIL CONSERVATION, May 1941.

¹ Chief, Soil Conservation Service, Washington, D. C.

But there was some consolation. Our escort took us over to see the Willard Torgim farm. Here there was little evidence of erosion.

Then they took us to a high point commanding a view over six adjoining farms—all the farms within an entire drainage basin—and again we saw little evidence of erosion or excessive run-off. These seven farms, like the Confer farm near Red Oak in west-central Iowa, had been treated in their entirety with an all-out, completely coordinated type of soil defense. They were part of the some 200 SCS-CCC soil-conserved farms in Winneshiek County—where soil and water were held in the fields and pastures, and where farmers insist they can stay and at least make a living.

At Decorah I had the pleasure of again meeting a gentleman who came into my office in Washington one day in 1935. He was a Member of Congress then. Said his name was Fred Bierman and that he had dropped in to find out what was going on in soil conservation—had no business, just getting acquainted with Government people, programs, and the like.

When he showed up at Decorah, I recalled his asking on this former occasion, nearly 6 years previously, "Were you ever in McGregor, Iowa?" "No," I had replied; "I don't recall having ever heard of the place."

"Well, it's an old place," the Congressman said, without seeming to have heard what I said. "The buildings stand mostly along a single main street, and back of these the ground rises rapidly to farming country several hundred feet above. The site of the town is a narrow valley; a creek flows down the bottom of the valley, through the town and out into the Mississippi River at the end of Main Street. It's a beautiful location—wooded slopes, for the most part, many birds, good farming country back on the uplands. May be some erosion up the hollows that slope down from the highlands to the floor of the main valley.

"McGregor is an old town. Its history is very interesting. It was an important shipping point in the heyday of Mississippi River traffic. Boats still call there occasionally, but the railroad handles most of the traffic nowadays. Many beautiful pearls have been collected in the locality, from fresh-water mussels. I suppose you can still find them.

"Mighty fine people in McGregor—good business folk, conservative, industrious. They love their town. But it has a drawback that doesn't seem to get any better; seems to be getting worse, in fact. Water gathering on the slopes during heavy rains rushes

down the draws and converges into the main valley stream. The town has constructed a rock-walled floodway which takes care of the lighter floods. But this overflows during heavy rains and sometimes—rather frequently, in fact—does a lot of damage. Spreads mud all over the streets, fills cellars, runs into the stores on occasions, and I've been told automobiles have actually been washed out into the river. The people are getting discouraged about the situation—the expense of it, the worry and uncertainty. The town seems really to have fallen into the clutches of a grievous flood problem, and judging by the amount of mud that they have to lift out of their cellars and haul off the streets, there may be an erosion problem higher up the drainages that follow down the hollows from above."

Finally the Congressman rose and started toward the door. "I'm not an engineer and I don't know," he remarked with an air of resignation, "but I suppose nothing can be done about the problem."

"What makes you think nothing can be done about it?" was my only reply. But that reply, put in the form of a question, seemingly gave the Congressman some hope. At any rate, he turned back, pulled up a chair, reseated himself and said, "What do you mean? Do you think anything really could be done—anything practicable?"

That was the starting point—the point that eventually led to visits to McGregor by Service engineers, agronomists, and other technicians. A careful survey was made of the entire watershed and cost estimates were computed. Finally, it was decided that something could be done. A plan was perfected. The McGregorans proffered various reasonable contributions. The Soil Conservation Service went in. Three detention reservoirs were constructed on the main "drainages that follow down the hollows from above," as Congressman Bierman put it. Erosion control practices were installed on all cultivated land within the drainage basin. Grazing was restricted or stopped entirely over the steep woodlands. Fires were controlled. The job is completed.

I went to McGregor to see how the setup was working out—just before our visit to Decorah. They had had a 2½-inch rainfall about a week before—a quick heavy rain of the kind which hitherto had sent charging floodwater and mud and muck all over the streets. But this time the floodway down through the town hadn't overflowed or come anywhere near overflowing. I was told by citizens and by flood specialists that this was the third heavy rain since installation of the detention dams and erosion-control



Gullies leading into the valley of the Trinity River. The whole slope stripped of topsoil and severely gullied. East Fork of the Trinity in violent flood, covering cotton, corn, pastures, houses and farm machinery.

work, and that not even a threat of flood conditions had occurred in the town. Everything had worked like a clock, they said. The general consensus of opinion was that the work already had saved the town thousands of dollars. One man estimated that the two 1941 rains, without the protection, would have cost McGregor around \$20,000. And the conservation-treated farms along the upper slopes showed great improvement since the time I last saw them. There was no evidence of serious soil washing by recent rains. The wooded slopes were turning beautiful again—clumpy and lush.

A highly successful job in erosion control, flood control, and silt reduction had been accomplished, all at one stroke—through the coordinated use of various measures to meet the needs of the land.

When I met Mr. Bierman in Decorah he expressed himself as greatly pleased over the success of the project.

While at McGregor we went 2 miles up the Mississippi River to Marquette, Iowa, to examine some of the effects of the 5-inch rain and resultant violent flood that struck there in the fall of 1940. Plenty of evidence of the damage remained. The estimated cost to railroad and other properties amounted to more than \$50,000. The town of Marquette is situated in the same type of valley as McGregor. The latter received the same amount of rainfall as Marquette, but it didn't cost so much. It did no damage whatever.

The miracle of Coon Valley.—If you had known the rolling lands of southwestern Wisconsin as they were on the occasion of my first visit to the locality in 1927, you would easily understand what is meant

by the miracle of Coon Valley.⁴

When the Soil Conservation Service demonstration project was started in the valley in 1934 sheet washing was rampant on most of the sloping lands, and gleaming yellow splotches of poor eroded subsoil were a prominent characteristic of the landscape; the main creeks were all flood streams; wildlife was disappearing; farm incomes were dwindling.

Driving about the valley on Sunday morning in early June this year, the countryside was peaceful, green, and beautiful, and erosion seemed to have been controlled. Most farms had turned to conservation; there was abundant evidence of increasing soil productivity, clearing streams, decreasing floods. More wildlife were in the hills and more fish in the streams.

Since my first visit, a rounded type of agriculture had been implanted upon the slopes of the hills and valleys. Bands of rotation strip crops, ribbons of contoured rows, winding terraces becomingly encircled the figure of Mother Nature, who, on that Sunday morning, was strutting her stuff in the billowing folds of June verdure.

Instead of the yellowing, bedraggled, pockmarked appearance of a country headed for poverty and abandonment, the evidence of which I had seen in 1927, the countryside seemed pulsing with life and vigor and had all the characteristics and fecund beauty of a growing, virile rural community.

I was told that 413 of the 800 farms in the valley had been successfully treated for the ills of the land during the period of the soil conservation demonstration; and that some 30 to 40 additional farmers of the community had adopted the conservation practices of their neigh-

⁴ See *Coon Valley—4 Years After*. By R. H. Musser. SOIL CONSERVATION, May 1939.

bors since the close of the demonstration. Also, under the new district set-up about half of the remaining farms were moving rapidly toward the safeguarding of their lands.

People who lived in the valley—farming there—told me of the increased income they derived from their operations as the result of soil and water conservation practices and readjustments in land use. They told me about the increasing wildlife, the better fishing, a better farm outlook, and other improvements on the land and among the people. I saw with my own eyes the darkening color of the soil resulting from increased soil-saving and soil-building crop rotations, used the new way, i. e., crop rotations practiced on the contour plan, rather than by isolated, unrelated fields. I saw the effectiveness of the control practices—the absence of rills and gullies in conservation-treated fields and their abundant presence on untreated land.

And then at a lovely picnic spot in a verdant valley, through which a diminutive stream babbled merrily, I joined with the people of the countryside, talked with them, picnicked with them, even spoke to them—about soil defense and national defense—and learned from them their great pleasure over the miracle of Coon Valley, and their renewed hope and faith in the land they tilled.

It was told not only by Coon Valley people but by others from various parts of Wisconsin that soil conservation had come in the very nick of time to save their farm lands, and their way of life. There were some four thousand of them at the picnic—men, women, and children, come together in celebration of the miracle that had been wrought on the farm lands of Coon Valley. We played baseball, talked, listened to the band, and ate fried chicken.

I took the liberty of mildly chiding the picnickers about their misinterpretation or violation of the ways of nature in undertaking to impose a straight-lined, square agriculture upon a round country. I pointed out that cows, sheep, and goats, when you turn them loose on a hillside, discovered long ago that it was easier to travel on the level than up-and-down hill. Of course, many farmers are still doing a lot of off-contour plowing in Wisconsin, but many others have learned that horses “blow” less when plowing on the level, and that man does not tire so quickly in following them around the slopes. They have also learned that tractors take it easier, use less gas, less oil, and do not wear so much; and that rainfall soaks more freely into the ground, to the benefit of the land.

So, I found that a real beginning has been made in Wisconsin, and down in Iowa—and Illinois too—with

contour farming and other soil conservation practices.

An Illinois soil conservation district.—There would have been quite a lengthy stop-over at St. Louis between trains—on my way to take part in another Soil Conservation Week celebrated by proclamation of the Governor, down in Arkansas—there would have been, that is, if one of the boys working across the river in Illinois had not come over to take me for a brief tour of the Shiloh-O’Fallon Soil Conservation District.⁵

Accompanied by the chairman of the district board of supervisors—a farmer—we went over four farms where soil-conservation jobs had been completed. The operators all expressed themselves as pleased with the conservation help given the district by the staff of technicians assigned to assist the farmers. They stressed the effectiveness of terracing, grassed waterways, contouring, pasture improvement, strip cropping, and wildlife work. The district is very active in replenishing wildlife on eroded farms by assisting with posting the land against unauthorized hunting and by encouraging the cooperation of hunters from town—cooperation to the extent of actually doing something to improve conditions for game.

The farmers of the district are hopeful that the conservation work will help to raise the water table of the locality. So many wells have lost capacity and so many springs have dried up that numerous farmers are now hauling water from town to country for their stock. Fifty or more farmers haul water from Belleville and others haul from the Mississippi River, in order to make up the deficiency—caused, the farmers believe, by excessive run-off of rainfall.

Some measure of how farmers like the district plan for handling the erosion and water problem is afforded by the steady increase in the size of the Shiloh-O’Fallon District since its formation in 1938. By petition of outside farmers and a vote requiring a double majority—a majority of all landowners voting and a majority of those approving—the size has been increased by six separate additions to the original area of 17,500 acres, owned by 264 operators, to the present acreage of more than 220,000, owned by 1,878 landlords.

Central Valleys District celebrates.—The Central Valleys Soil Conservation District⁶ covers 1,275,000 acres in central Arkansas. The occasion of my visit was the celebration of the establishment of the East Cadron Creek soil-conservation demonstration in 1934 and the subsequent setting up of the Central Valleys District in 1938. Again some four thousand rural

⁵ See *To Promote the General Welfare*. By the Directors of the Shiloh-O’Fallon Soil Conservation District. SOIL CONSERVATION, Nov. 1940.

⁶ See *New Patterns of Land Use in Two Southern States*. By Wellington Brink. SOIL CONSERVATION, June 1939.



Contour strip cropping; corn, grain, alfalfa, grain, alfalfa. Protected woodlot in background.

people came together to celebrate progress in soil conservation. We talked about control of soil erosion and about national defense and had a wonderful time.

Governor Homer M. Adkins gave an outstanding talk on soil conservation, saying among other things:

"I have watched this soil conservation program and I know what it means to the hill farmers of Arkansas. I am delighted to see so much of this poor, eroded, steep land going back into permanent pastures. There is Arlie Odom, one of my friends here in Van Buren County, who has a 220-acre farm. Arlie, who is a cooperator with this district, has retired 100 acres from cultivation to permanent Bermuda grass pasture. He has kept 75 acres of his best land in cultivation, and he is protecting it from soil erosion with what technicians of the Soil Conservation Service call a complete conservation farming system. He has terraced this land, he has strip crops on it, and he is improving the soil with a good crop rotation.

"Many of you also know Riley F. Trawick in Cleburne County. Riley Trawick, another of the farm cooperators with the Central Valleys District, has sodded about 300 acres of old pasture to Bermuda grass and has established 20 acres of new Bermuda grass from cultivated land. And he's using this pasture to grow good livestock. I believe that Riley now has about 50 high-grade Shorthorn breeding cows. The land he has kept in cultivation is protected by terraces, contour cultivation and strip crops, and Riley Trawick thinks so much of the soil-conservation program that he has helped about 20 of his neighbors to get assistance from the district too."

The Central Valleys Soil Conservation District comprises 1,315,000 acres in the central part of Arkansas. By the end of May 1941, plans had been completed for work on 1,305 farms covering 156,000 acres. The district supervisors, on this date, had received 1,796 applications for plans and work. Conservation surveys had been completed for 671,000 acres, and work was rapidly advancing in many communities. During May, 18 group meetings and 16 educational meetings were held in various parts of the district.

Group planning.—In both Iowa and Arkansas, I found that group planning for soil and water conservation is bringing remarkable results. In the former State the system, as used in districts, deals with small groups of about 6 to 10 or 12 farmers living within small watersheds. In Arkansas small community groups usually constitute the unit for planning. In both instances, certain farmers are taking leadership in getting the movement under way; in some of the Arkansas districts the supervisors are pushing the movement to the extent of designating, more or less unofficially, some of the community leaders as assistant supervisors.

It is being found that this method not only is getting a quicker and better understanding of methods of sound conservation practice and of such fundamentals as land-use capabilities, but farmers are showing a decided improvement toward getting actively into the program.

In the Pleasant Valley community of the Central Valleys District, 33 farmers, after meeting together with a few technicians several times, and after doing

STATE OF ARKANSAS
Executive Department

PROCLAMATION

To All to Whom These Presents Shall Come—Greetings!

WHEREAS, Arkansas has been wonderfully blessed with natural resources which include a great variety of bountiful soils;

WHEREAS, the soil, which provides our food, clothing, and most of our shelter, is our most important natural resource;

WHEREAS, soil erosion, which saps the vitality of our soil and thereby threatens the very foundation of our State and our Nation, is attacking more than 16,000,000 Arkansas acres and has ruined for further immediate productive use more than 1,000,000 acres;

WHEREAS, the people of Arkansas have been quick to recognize the grave problem of soil erosion, and the State of Arkansas became the first State in the Nation to enact a soil conservation districts law enabling landowners to organize soil conservation districts for a cooperative attack on soil erosion and related land-use problems;

WHEREAS, the soil conservation district movement provides for the operation of the democratic process in agriculture, permitting our people to solve their problems with the petition and the ballot;

WHEREAS, the landowners of Arkansas have organized 30 soil conservation districts and have in process of organization 8 other soil conservation districts, all covering more than 18,650,000 acres;

WHEREAS, more than 11,000 landowners of Arkansas have entered into cooperative agreements with the supervisors of their soil conservation districts for the establishment of complete and coordinated soil conservation farming systems on approximately 1,360,000 acres;

WHEREAS, each month more than 500 farmers, owning

and operating approximately 60,000 acres, are entering into cooperative agreements with the supervisors of soil conservation districts;

WHEREAS, soil defense is an integral part of national defense, and the soil conservation efforts of our people are making America more than ever worth defending;

WHEREAS, this is the seventh anniversary of the establishment of the East Cadron Creek Watershed in Faulkner, White, and Cleburne Counties as the first demonstration project of the Department of Agriculture Soil Conservation Service in Arkansas, the sixth anniversary of the establishment of CCC camps in Arkansas to assist farmers in controlling soil erosion, and the third anniversary of the beginning of operations in Arkansas soil conservation districts, which placed the conservation program directly in the hands of landowners;

WHEREAS, the State of Arkansas will be honored by a visit from Dr. H. H. Bennett, Chief of the Soil Conservation Service, of Washington, D. C., who will speak at a State-wide soil conservation rally at Damascus, Tuesday, June 10;

NOW, THEREFORE, I, HOMER M. ADKINS, Governor of the State of Arkansas, do hereby proclaim the week of June 9-14 ARKANSAS SOIL CONSERVATION WEEK and respectfully urge that the citizens of the State of Arkansas observe this week fittingly by renewing our resolution to conserve, improve, and develop our great soil resources not only for our own benefit but also for the benefit of the generations to follow us.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of State in the Governor's office this 29th day of May, 1941.

[[SEAL]]

(Signed) HOMER M. ADKINS,
Governor.

(Signed) C. G. HALL,
Secretary of State.

considerable planning on their own account on their own farms, joined in and worked on each other's farms until such heavy work as terracing and preparing water channels was completed or carried as far as immediate needs called for. As rapidly as the farms were planned, neighbors in the Pleasant Valley community pooled their teams and equipment and helped, farm by farm, to install various items called for in the plan.

At Damascus, I met Thad Harper, a 73-year-old farmer who, with his 23-year-old mule, had helped with terracing and other work on 31 of the 33 farms in the Pleasant Valley community. I was told that during the course of the group discussions and the self-help planning of farms in this community, Mr. Harper made the first public talk of his life—on the subject of soil conservation.

Floods on the Trinity.—From Arkansas I went to the Texas "Black Belt," along the Trinity River, arriving in time to see some of the flood damage resulting from permitting too much of the recent rains to run off the land and pile up in the Trinity and its affluents.

On June 12, we found that every unprotected cultivated field from Fort Worth to Rockwall County

had lost much soil by sheet washing and gullying. Some fields had lost in the neighborhood of 25 tons an acre as the result of the June rains this year. Cotton and corn were buried at the foot of slopes, and the Trinity was over its banks in great stretches of muddy flood water, inundating thousands of acres of cotton, corn, pasture, and small grains.

At one place in eastern Dallas County, I walked across a long slope extending from a highway down to the edge of a broad overflow of the East Fork of the Trinity, caused by a break in the levee. Here gullies opened up years before by erosion that easily could have been prevented, had been speeding water into the Trinity. For approximately half a mile every vestige of topsoil had been washed from a former field of rich Black Belt clay, down to an impervious subsoil as favorable for shedding rainfall as a metal roof. This break in the levee of the East Fork was in the locality of Mesquite, where an SCS-CCC camp has treated 43,000 acres for soil conservation.

The conservation work that had been done in the Black Belt generally had held erosion to a relatively low degree throughout the rainy season in the areas treated, especially where strip cropping, terracing,

(Continued on p. 81)



EROSION CONTROL FOR RESERVOIR PROTECTION

BY HARRY E. REDDICK¹

THE East Bay Municipal Utility District is usually referred to by those living on the east side of San Francisco Bay as "the District." Water supplies for domestic and industrial purposes are supplied by the district to a population of more than 500,000 people living in towns, villages, and communities scattered along the eastern side of the bay, or in close proximity to it, from Hayward on the south to Crockett on the north where the bridge spans Carquinez Straits. The cities, towns, and villages served include Oakland, Alameda, Berkeley, Richmond, Piedmont, El Cerrito, Albany, Emeryville, and San Leandro. In addition these rural districts are served: Castro Valley, Lafayette, Kensington, San Pablo, Fairview, Saranap,

Chabot, Colonial Acres, Orinda, Ashland, Mulford Gardens, Rodeo, and Pleasant Hill.

The Soil Conservation Service has been actively concerned with this municipal utility organization since January of 1940 when Chief Bennett signed an agreement with the East Bay Municipal Utility District agreeing that Service technicians in the region would develop an erosion-control program to be used on watersheds surrounding local reservoirs of this non-profit publicly owned corporation for the purpose of reducing the rate of sedimentation in their storage basins.

Seventy-five percent of the water used by the more than half a million people in the district comes from the Mokelumne River that drains a watershed of 575 square miles in the Sierra Nevada Mountains in Al-

¹ Regional conservator, Pacific Southwest Region, Soil Conservation Service, Berkeley, Calif.

pine, Amador, and Calaveras Counties, a hundred miles or more from the areas where it is used. The water is taken from the Mokelumne River into the Pardee Reservoir near Valley Springs, Calif., for storage. This reservoir, with a capacity of over 210,000 acre feet could, if filled, supply the present needs of the district for more than 4 years.

The water from the Pardee Reservoir is distributed to the district through 93 miles of aqueduct with a gravity-flow capacity of 40 million gallons a day which can be increased to 70 million gallons by the use of pumps located near the boundaries of the district at Walnut Creek.

Storage at the western end of the Mokelumne Aqueduct is provided by local terminal reservoirs having a combined capacity of 101,550 acre feet. The run-off from the drainage areas tributary to these reservoirs is impounded, and it provides the balance of the draft for the district not diverted directly from the Mokelumne River. A large excess storage is provided in the local reservoirs to furnish a continuous water supply in the event of a break in the main aqueduct leading from Mokelumne River. A severe break, such as might occur during an earthquake, could put the aqueduct out of use for a period of 6 months, during which time the increased draft on these reservoirs would exhaust the local storage. Thus, the terminal reservoirs form an important link in the distribution system.

The watersheds surrounding the local reservoirs of the East Bay Municipal Utility District are contiguous to each other. Together they comprise a strip of rolling, hilly-to-mountainous land, with detached valleys along minor stream bottoms, approximately 18 miles long and 5 miles wide, lying in Alameda and Contra Costa Counties. Elevations vary between 240 feet to 2,000 feet above sea level. The precipitation, 60 percent of which occurs in the 3 winter months and 89 percent from November to April 1, ranges from 22 to 30 inches per year. Approximately 500 families live within this area, mostly professional or businessmen who commute between their homes and the Bay area.

The watersheds vary in size as follows: Lake Chabot, 11.75 square miles; Upper San Leandro, 30.30 square miles; Lafayette, 1.34 square miles; San Pablo, 32.15 square miles; Pinole, 10.50 square miles. They have a total area of 86.04 square miles. The district-owned portions of these watersheds are as follows: Lafayette, 100 percent; Chabot Watershed, 92 percent; Upper San Leandro, 45 percent; San Pablo, 56 percent; Pinole, 24 percent.

Grazing has been the primary agricultural enterprise

since the time of the early Spanish land grants. Greater amounts of grain and hay were grown in the early days than at present, although within the last 30 years but few changes have occurred in either the types of crops or in the area under cultivation. Grain, tomatoes, pears, and alfalfa are grown to some extent, mostly on private land. Approved rotations have been adopted on all of the 270 acres of district-owned land under cultivation on which agreements have been signed.

Four reservoirs are now in operation and another (Pinole) is proposed. San Pablo has a capacity of 43,149 acre feet; San Leandro, 41,398; Chabot, 12,553; Lafayette, 4,450 acre feet.

The slopes of the ground surface draining into the main streams are relatively steep and range in grade from 10 to 40 percent and even higher. Sheet erosion is not severe over most of the areas, but large quantities of sediment are carried into the reservoir each year from numerous actively eroding gullies and drainage channels.

The watersheds of the district contain some small areas of cultivated lands located principally in the small valleys and along the stream channels. The hilly portions are utilized mainly as grassland for grazing or are wooded or covered with brush.

The district has by no means been unaware of the sedimentation that is affecting their reservoirs. For the past several years of their own initiative they have carried on studies and done some work in controlling the problem.

L. Standish Hall, hydraulic engineer of the district, has estimated that it costs approximately \$55 per acre foot to provide the storage they now have, and it seems probable that this figure will increase, should additional storage be needed in the future, as a result of advance in land values as subdividers open new areas along the valley floors. Because of the costs and for other reasons, a survey was made to determine just how fast the reservoirs of the district were filling with sediment. The survey in 1939 of the San Pablo Reservoir, a storage basin designed to hold 43,149 acre feet of water, revealed that 2.63 percent of the total capacity of the reservoir had been destroyed by deposited sediment since its establishment 21 years before.

Although the rates of sedimentation are moderate in the district's reservoirs, the amount of erosion per acre of watershed is exceptionally high. Observations show that the sources of sediment are, (1) natural watercourses, (2) accelerated or man-made gullies, (3) private agricultural lands, and (4) landslides and slips.

The movement of the sediment is caused by, first, increased run-off resulting from construction of roads, buildings, etc., and improper land use and cultural practices; second, the seasonal distribution of rainfall; and, third, the character of soil and topography.

The program worked out jointly by Service technicians under Area Conservationist Gosline and Mr. Hall for the district is designed to reduce gradients and minimize abrasive action in streams by means of check dams, and to reduce erosion on the watersheds by means of planting. In more detail it includes the following specific practices:

1. Erosion-control structures in natural waterways, accelerated gullies, and roads.

2. Plantings:

- (a) To stabilize gullies.
- (b) For protection of streambanks.
- (c) To stabilize road banks.
- (d) For stabilization of watersheds by forest plantings.

3. Proper land uses.

4. Protection of wildlife.

"If we can reduce the silting by one-half, the program will be worth while," Mr. Hall commented regarding the program.

Some of the private owners of land in the watersheds already have started erosion-control work on their own initiative. Since the law governing the district prohibits their spending money on privately owned land, and since their purchase of such land at "city lot" prices is impractical, the control of erosion on the privately owned areas will have to be the result of voluntary action or of some form of agreement with the Soil Conservation Service or another agency.

While the proposed boundaries of the contemplated soil conservation district in Contra Costa County do not include the privately owned lands of the East Bay Municipal Utility District watersheds, it is hoped that these areas may be added at some future time. The Soil Conservation Service is well equipped to provide farm plans for such areas, should they be included in a district. A progressive physical survey of the watersheds has been completed, and land-use capability maps have been prepared. The agreement signed by Chief Bennett on January 22, 1940, applied only to the watersheds owned by the district in Alameda and Contra Costa Counties; it included watersheds of San Pablo, Lafayette, Pinole, and San Leandro Creeks. However, the agreement does recognize the necessity for erosion control on the interspersed privately owned lands.

The district agreed to furnish technical data, now

available, that will be of assistance, and to continue observations relative to run-off and sedimentation. They also agreed to carry out plans prepared by the Service technicians and to perform such operations as were included in the agreement.

Separate agreements are drawn up for areas of 40 to 1,000 acres, depending on the size of particular watershed segments. After the conservation plans for all units are developed by the division of farm management of the Service, they are reviewed and approved by technicians of both agencies. The work is to be done with WPA labor in accordance with Soil Conservation Service recommendations.

The program calls for the planting of trees. To date 57,000 trees have been set out, in addition to 200,000 cuttings. The trees and cuttings include conifers, broadleaf evergreens, and deciduous species. The trees for the planting program will be supplied by the regional nurseries of the Soil Conservation Service at Pleasanton. It is estimated that more than 200,000 will be used during the winter of 1941 and 1942.

Both reservoirs (Missouri type) and check dams will be used on small tributaries to the main streams. On San Pablo Creek one large concrete dam designed to discharge flood flows up to 9,000 second-feet of water, has been recently completed.

The completed structures have just passed through a season of local precipitation averaging about 50 percent above normal. All the structures functioned satisfactorily during the heavy run-off resulting from this wet winter, thus demonstrating their effectiveness in controlling erosion from the watershed.

WANTED: TECHNICAL ASSISTANCE ONLY

(Continued from p. 69)

use the slopes because of their high investment in the land. On such slopes, they use bench terraces—a sort of stairstep arrangement on roadways around the hill. This allows for pulling spray rigs and other equipment along the graded terraces, with the trees planted between, where the original slope is undisturbed. Typical examples can be seen on the farms of Dr. Gale Gleason, Leslie Jameson, and Merton A. Gilmore.

Roy Hooper was picking crab apples. He showed us the marl he had spread, the peat mulch under his cherries, his contour orchard set in the spring of 1940, and his newly constructed bench terraces.

Harold Jameson wanted some contour lines run in connection with reseeding a pasture. The soil conservationists were too busy to help him. "Then lend me your levels and I'll run them myself," Jameson

(Continued on p. 86)

FOOTPRINTS IN HIS FIELDS

BY WILLIAM C. PRYOR ¹



Sighting contours.

THE name on the mailbox in front of his Iowa farm is S. F. Emerson, but everybody calls him "Rook". He believed in farm conservation when a lot of his neighbors were still dubious about it.

Even his father-in-law, William Reiger, was doubtful, and insisted to the last on having his fields neat and square and the rows straight and orderly no matter how the land lay. That is the way it was until one day William Reiger's time came, and there was the farm left to his two daughters, and Rook with the job of running it. You might think it was not a very attractive proposition for a man to rent a place from his wife and sister-in-law, but for Rook it was all right, because his wife is in sympathy with his views on conservation farming, and his sister-in-law had no objections.

He went ahead, slowly at first, with his plans. The farm was near but not in the area of the Indian Creek demonstration project, and there was no soil conservation district, districts being new in Iowa. But Rook Emerson was determined to farm the place along conservation lines; he visited the project, read conservation, attended conservation meetings whenever he had a chance. He found that reading, looking, and listening did not lay out contours and build terraces, however, and then it was that he decided on direct action.

His method of attacking the problem was a little unusual. He saw an opportunity not only to improve the farm he was operating but to advance the whole idea of conservation farming in an area where some people were inclined to think it was just "something the boys in Washington had thought up."

He went to the instructor of the vocational agriculture class at the high school at Lisbon, Iowa, and

offered his farm to the class as a laboratory for trying out conservation practices. This was "right up the alley" of the "voc-ag boys"—they accepted with enthusiasm. Emerson entered into a 5-year agreement with the class, just as though it were a demonstration project or a district.

The class held five meetings which were given over entirely to discussing the Emerson farm and its conversion to conservation farming. Harold Nilsson, SCS conservationist at the area office in Marion, attended the meetings and cooperated with the instructor in directing study by the class of the farm and its problems. They studied conservation-survey symbols, contour mapping, variations in soil types, types of erosion, crop rotations and supplementary practices, and other fundamentals. Emerson himself attended one of the early meetings to explain the crop and livestock plan then being followed on the farm and to tell them what he would like to do in the future. He had tried one cornfield on the contour in 1940, with good results, so that he had a rather clear idea of what he wanted.

With the fundamentals taken care of, the boys set to work preparing the farm plan. They studied the soil, balanced the rotations, set up a new pasture plan, and prepared a limestone chart providing for liming specified acreages of pasture and crop land each year. The finished plan included maps showing the results of the soil survey, the proposed land uses, and the limestone requirements.

Rook attended the fifth meeting of the class and after going over the plan with them accepted it. Then the boys started field work. Having no funds for surveying equipment, they utilized a small farm level and an ordinary carpenter's level for which they built, in the school workshop, such adjuncts as would make them adequate for the job.

Then with their instructor, Severin Sorenson, and Nilsson advising them, they went to the farm and laid out the contours. Afterward they plowed the boundary furrows to indicate the contours. When Emerson began spring plowing this year, he plowed on the contour instead of up and down. He is pleased with the results—pleased, in fact, with the results thus far from every phase of the farm plan.

The boys' plan provided the following: Liming 6 months prior to the seeding of legumes, according to the liming chart; inoculation of legume seed; seeding of waterways to a mixture of red clover, alsike and

¹ Division of Information, Soil Conservation Service, Washington, D. C.

timothy; and no burning of cornstalks or other crop residues or fence rows, although such burning still is a popular practice with many midwestern farmers.

The rotations set up run from 3-year rotations of corn, oats-clover-timothy, and clover-timothy, to 6-year rotations of corn, corn, oats-alfalfa, and 3 years of alfalfa on certain fields after the prescribed liming schedule has been carried out. Limestone requirements vary from 1 to 3 tons an acre, and according to plan about 19 acres will be limed each year during the life of the 5-year agreement.

Under the plan drawn up by the boys, Emerson will find at the end of the 5-year period that his corn acreage is about the same, except for annual fluctuations due to the rotations; his oats acreage will be increased slightly; his clover-timothy acreage will be cut from a little more than 30 acres to about 18 acres; and 19 acres of alfalfa will be grown where none grows today.

The land devoted to permanent pasture has been reduced from about 62.5 acres to 51.9 acres, but because of greater hay production Emerson can increase his dairy herd and, of course, his income from that source. The plan for the pasture area provides for liming, disking, application of superphosphate, and reseeding with a mixture of sweetclover, red clover, alsike, timothy, and oats.

The results? After all, the plan was not put into effect until this year, but Rook says that results already are apparent, and he expects to make a better corn crop this year than he ever did when he planted his corn in straight up-and-down-hill rows. I myself saw some visible results the day I visited his place with Nilsson and Walter John of the Milwaukee office. The night before it had rained—a “gully washer” if I ever drove through one—and Rook proudly showed us his strip-cropped sloping fields—there had been hardly any soil washing. On the neighboring hillside fields of another farm, where the rows ran straight, some of the corn had been almost washed out.

Every time there is a big rain, Rook finds footprints of visitors in and around his protected fields. The folks around have been a little doubtful, but just the same they are checking on the results. Rook told us that often farmers drive along the road and when they think he is not about they stop and study the fields, then drive away quickly if they see him coming.

“I don’t know why they don’t come right up to the house and talk to me,” he said. “I’d be glad to show them all around and talk about it. I’m glad to talk conservation whenever I get a chance. It’s great stuff.”

It looks as though Rook Emerson’s idea of letting

schoolboys experiment with his farm is paying out as he expected it would. The farm is being improved—there is no doubt about that—and the neighbors are getting the idea—no doubt about that, either. Look at those footprints in the fields, and men looking over the fences. Nor are the high-school boys at all backward in spreading the good word around.

As to the real “pay-off,” it came when one of Rook’s neighbors called Severin Sorenson and asked if the vocational agriculture class would stake a contour line for him to follow in planting corn. Rook is a little amused at this, but he doesn’t laugh. It is no more than he had expected. He doesn’t mind being a pioneer. He knew what he wanted, and he got it. Now he hopes that all his neighbors will do likewise—get conservation established on their farms. As he remarked, “It is too important to be kept as a secret or to restrict to one farm.”



Constructing boundary furrows.

LAND AND PEOPLE

(Continued from p. 76)

and contouring had been employed so that one measure supported another. Some washing had resulted along the lower part of long slopes where strip cropping with oats had been the only measure employed. The oats were of very poor quality—about one-fifth of a crop—and had failed in a number of places to provide normal obstruction to the flow of water—and to erosion of the wet soil.

Glimpses at conditions in these and other States where heavy June rains have followed a long, dry spring, invariably revealed the effects of severe erosion, flooding, and silting damage in all unprotected fields with contrasting conditions of little or no damage in the vast majority of conservation-treated fields.

Obviously, it pays to control erosion, and now that it has been shown throughout the nation that it can be controlled or greatly reduced with practical measures, people are coming to the defense of the land as an inseparable part of good business and national defense.



CCC enrollees from the Mocksville camp handle drag pans pulled by neighbors' teams, demonstrating an economical way of building terraces.

TERRACES AND NEIGHBORLINESS—ALL WITHIN A DAY

By ARTHUR W. SUSOTT ¹



Six students at North Carolina State College of Agriculture and Engineering got first-hand experience in terrace building during the demonstration on the Beck sisters' farm. Two of them are here seen plowing up the terrace site while others study the work.

ALBERT YARBROUGH, farmer living near Churchland in Davidson County, N. C., is an early riser at all times, but on April 22 he was out and on his way, shortly after 2 a. m., to the neighboring farm of George F. Smith. With Smith he then drove on to Salisbury, 12 miles away, where they stopped at a packing plant and loaded 140 pounds of fresh barbecue pork into their car. By 4 a. m. they were back in the Churchland community, this time on the farm of Miss Alice and Miss Cynthia Beck.

¹ Chief, regional division of information, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

Soon a large bed of glowing wood embers was sending up piercing heat waves from a barbecue pit that had been dug the night before not far from the Beck home. A few minutes later the tantalizing aroma of meat slowly roasting over an open fire spread through the air.

By 8 o'clock the narrow lane to the Beck home was crowded with cars. Neighboring farmers and their families were arriving to take part in a community terracing demonstration, especially planned to help the Beck sisters start a soil conservation program on their 50-acre farm. The two elderly women had not found it easy to run their farm since their four brothers left the home place to begin farming for themselves. In recent years they had rented most of the cropland, and the planting of corn and cotton year after year had begun to injure the land. It had become badly eroded and good yields were difficult to maintain.

During March the Beck sisters entered into an agreement with the Middle Yadkin Soil Conservation District to carry out a complete conservation program on their farm in Davidson County. This county along with four others—Cabarrus, Rowan, Davie, and Iradell—form the district, covering 1,468,160 acres.

The average farmer can establish the practices recommended in a district conservation farm plan without a great deal of difficulty, but the Beck sisters no longer had men folks on the farm, nor could they afford to hire help. On this day, neighbors were coming to help. They were going to terrace 10 acres of land, most of which was to be put into cultivated crops under a new plan of soil conservation. With

terraces, strip cropping, improved rotations, and other soil-saving measures a good portion of their farm could be used safely for cultivated crops.

By 8 o'clock, shouts directed at teams of mules and horses pulling plows and drag pans, and the steady, loud exhaust of tractors, were echoing across the farm. Albert Yarbrough, John Long, Lloyd Davis, and Jesse Beck, a brother of the Beck sisters, brought teams for pulling plows, drag pans, and V-drags, while Hugh Davis and Ellis Snider furnished tractors and other heavier terracing equipment. The Middle Yadkin Soil Conservation District provided a tractor, a No. 1 grader, a No. 2 grader, and 4 drag pans.

Throughout the day the terracing equipment was kept busy. Farmers who had come to observe the use of different kinds of equipment moved about freely. This was one of the first demonstrations in the State to use at least six different kinds of equipment in building terraces. Most farmers appeared particularly interested in the drag-pan or slip-scraper method, which has become popular in the Southeast. All that is needed for this method, after the terrace site has been staked out and plowed, is a team of mules or horses, one man to drive the team, and another man to handle the drag pan. Some farmers use only one mule and handle both the mule and drag pan.

Teams not hitched to drag pans during the demonstration were pulling home-made and factory-built V-drags. The tractors pulled the heavier terracing equipment, No. 1 and No. 2 graders, and a two-bottom disk plow.

Promptly at noon, Albert Yarbrough's voice boomed, "Come and get it!" Teams were unhitched, tractor motors shut off, and lines of hungry men began forming near long tables laden with pans of barbecued meat, salads, cooked and fresh vegetables, pies, cakes, and other food. More than 150 persons were served—many of them a good second helping. The expense of buying the barbecue meat to feed the large crowd was defrayed by contributions from those attending and a sizable check from the Davidson County Farmers Mutual Exchange.

Following the luncheon was a rest period, with short talks by County Agent P. M. Hendricks, O. F. McCrary, district agent of the North Carolina Extension Service, H. E. Newland, work unit technician of the Soil Conservation Service, and others. Also, during the noon hour the farmers studied a large chart placed under a cedar tree; the chart showed new land-use plans as developed for farms in the district.

"We have built terraces before," said County Agent Hendricks, "but today we know how to build them



D. G. Wilson, Linwood, N. C., supervisor of the Middle Yadkin soil conservation district, discusses with Cynthia and Alice Beck the good times farm folk used to have at community events. They agree that terracing bees are the sort of thing needed to preserve the wholesome flavor of rural life.

better. I'm sure the methods we are demonstrating today will help you build good terraces inexpensively and with equipment you have on your farm. As you have already noticed this morning, you do not have to have a big tractor and heavy terracing equipment—you can do a fine job with a team of mules, a plow, and a drag pan."

Mr. McCrary asserted that one of the surest marks of good citizens is rural land well protected against erosion. "Too much land," he deplored, "has been farmed without proper regard for its protection against erosion."

Mr. Newland, who helped the Beck sisters in developing a district conservation plan for their farm, explained the need for employing a variety of conservation measures on the farm to ensure maximum protection against erosion. He told of the district set-up and the opportunity it affords for community action in better land use and soil conservation.

By five in the evening the terracing had been completed—5,500 feet on 10 acres. On the north side the newly built terraces connected with those already built on the neighboring farm of Elmer F. Yarbrough, a son of Albert Yarbrough. In a natural draw in the Yarbrough field is a well-established meadow strip that will catch the terrace water from both the Yarbrough field and the north side of the Beck field. Terrace water on the part of the Beck field that slopes away from the Yarbrough farm will empty into a woods and other safe water-disposal areas.

"Elmer is glad to see those terraces hook up with his," said Mr. Yarbrough, "as too much soil was washing down from the Beck field on to his land."

The Beck sisters were most grateful to their neighbors for the terracing work done on their farm and to those who had helped arrange the demonstration

and barbecue. "I don't know how to thank you," said Miss Alice. "This has been a wonderful day for Cynthia and me. It reminds us of the gatherings we farm folks used to have years ago, and it may be that this kind of thing will help bring them back again." The members of the barbecue committee—Albert Yarbrough, George F. Smith, and S. A. Allred, vocational agriculture teacher in the Churchland community—were also pleased, especially with the weather, as heavy rains had forced postponement of the demonstration on two previous occasions. But on this day the weather was perfect, the sky cloudless and the sun warm.

District Supervisor Wilson was enthusiastic about the possibilities of terracing demonstrations and other district-sponsored activities for preserving the wholesome flavor of country life. "Our rural churches and schools have played an important role in our rural civilization, but many of these have disappeared," he remarked. "We must find new ways of preserving a close and intimate relationship among rural people. We cannot let that disappear."

With the terracing completed, the next step on the Beck farm is to establish the other conservation practices. This is not as hopeless as it might seem, in view of the fact that the two women are not in a position to hire help. Jesse Beck is of the opinion that he and his brothers, all living in Davidson County, can spend sufficient time on their sisters' farm to see that other conservation measures are put on the land and maintained.

"After we married and left the home, it seems the place just went down," Jesse said. "Our sisters couldn't do the work, and there was nothing to do but rent the land. The renters put the land in corn and cotton year after year—and you can see what happened. I'm not blaming them because it was the natural thing to do. I believe, however, that with the terracing, and by working in better crop rotations, strip cropping, and more lespedeza, we can stop the land from washing and make it produce better crops. Some of it will have to be rented out, but if the neighbors who are here today rent it, I'm sure it will get good care. My brothers and I will pay more attention to the farm than we have in recent years."

Jesse and his brothers are deeply attached to the home place. They tell with pride the story of a stagecoach route, operated between Salisbury and Winston-Salem during colonial times, that crossed the Beck farm. During the terracing demonstration Jesse pointed out the place where the stage road had been

and the site of an inn. All that is left of the latter is a basement hole overgrown with forest growth. George Washington and other leading early Americans were guests at the inn, Jesse said. Five miles southwest of the Beck farm is a cave that Daniel Boone used. A community park has been built near the cave.

The Beck sisters' farm is the nineteenth in the Potts Creek watershed for which a complete conservation plan has been developed. The 19 farms cover 1,020 of the 1,500 acres in the watershed. It is hoped that the remaining 6 farms soon will be under conservation farming so that the entire area may be protected against erosion. Potts Creek flows into the Yadkin river.

The conservation plan for the 50-acre Beck farm calls for 2 acres of cotton each year, to be grown in a 2-year rotation with annual lespedeza between permanent strips of *Lespedeza sericea*, and 6½ acres of small grain followed by annual lespedeza in a 2-year rotation on the balance of the cropland. Each year all of the cropland except the 2 acres in cotton will be in either small grain with annual lespedeza or in annual lespedeza that has reseeded itself.

In developing the conservation plan it was found necessary, because of the relatively small size of the farm, to increase the cropland from 10 to 17 acres by utilizing 7 acres of idle land. Formerly, 5 acres had been put into corn almost every year, but under the new plan no corn will be grown. Small grain will take the place of corn, as it provides good winter cover for the land and fits into the new crop rotation. The cotton acreage is the same as before.

One acre of *Lespedeza sericea* will be established as a border along the woodland to prevent the encroachment of forest growth into open fields and to provide food and cover for wildlife. About half of the farm is in woodland, and 9 acres of it has been used as woods pasture. These 9 acres will be protected against grazing to encourage the growth of good timber, and 3 acres of badly eroded land will be planted to pine seedlings. The home site and garden occupy 2 acres of the farm.

Late in the afternoon of this day, as the farmers and their families began to leave, Alice and Cynthia Beck stood on their front porch looking toward the gently winding terraces their neighbors had built for them—all within a day. Their faith in neighborliness and in the home place had been happily renewed.

SOON TO APPEAR

Watch for Ed Ogg—he's on his way from a relief job to farm independence. Inspiring to everyone is the story of this man who is "conserving" his way to farm prosperity.

RAINS ON THE PLAINS

By L. L. HARROLD¹

JUNE 1941 brought copious rains to the semiarid region of the Central Great Plains. Except for the erosion in cultivated fields, the moisture was beneficial—to the extent, in fact, that the luxuriant growth of vegetation surpasses that of many years. Early travelers in this area must have seen the countryside in a somewhat similar condition. At any rate, their glowing accounts attracted many farmers to reap abundant harvest of the land in the abnormal wet years. How well these agriculturists learned that the wet years were the “unusual” is a matter of history; and they learned too that their land-use program must be planned around a supply of moisture considerably less than the unusual.

The Republican River and many of its large and small tributaries flooded because of the June rains of this year, with considerable damage to bridges, highways, and fertile flood plains along the major streams. Yes, and considerable damage to farm land in the headwaters of the basin. In the straight lister rows running up-and-down hill, many miles of 3-inch-high corn were completely washed out along with tons of rich soil.

The preliminary results on the Central Great Plains experimental watershed show that of the 6 to 7 inches of rain which fell in 8 days from June 2 to 9, about 2 to 3 inches fell in a day and a half, with a maximum 10-minute intensity of 5 inches per hour. The watersheds with corn in up-and-down hill straight lister rows lost much corn and soil, and 2.5 inches of run-off for the entire storm. Over half of the heavy rain ran off. Even some of the lister rows of corn that were on the contour were overtopped and broke; but the total loss of corn and soil and run-off was considerably less than that for the straight rows. From the contoured cornfield, 1.6 inches of run-off was measured for the entire storm, and 1 inch for the heavy period.

The wheat, oats, and the strip-cropped watersheds produced less run-off than the cornland during all parts of the storm. For the entire storm the contoured wheatland shed 0.6 inch of run-off, while wheat in straight rows shed 1.4 inches. Oats on the contour shed 1 inch of run-off and straight rows 1.5 inches. The pasture watershed produced about 1 inch of run-off, the meadowland 0.2 inch, and the contour-fur-

rowed pasture only a trace of run-off for the entire storm.

From the standpoint of moisture conservation, a major agricultural problem in this region, it appears that contour cultivation is the most effective practice. Eight-tenths of an inch more water was lost from all cropland in straight rows than from all the cropland on the contour. This amount of moisture—the difference between that retained on contoured land and that retained on land cultivated in straight rows—is of great importance as it may later mean the difference between a good crop and none at all.

From the standpoint of flood control the differences in run-off from land under various crops and types of cultivation, as mentioned above, are significant in that they may be effective in taking the top off a flood peak. However, other conditions may show other results, as the data presented above are for one storm only, and one condition of land and cover, and as such they represent but one point on a curve.

WHAT DO THE ASSESSORS SAY?

Farmers of the Montesano-Elma-Oakville Soil Conservation District in Grays Harbor County, Wash., received an authentic tip at the county assessor's office as to what erosion has been costing them.

The assessor's records showed that from 1912 to 1940, streambank erosion, caused by fast-flowing rivers draining watersheds with a large amount of cut-over timberland, had eaten away 38.9 acres of rich bottomland on two farms alone along the Wynooche River. The cutting was so severe that it was necessary to remap these and other farms several times in that period in order to maintain a fair assessment base.

To the county, this meant a cut in assessment valuation of \$2,939, and \$81.40 less tax return every year than would have come into the county exchequer had this erosion been headed off a few years ago. In addition, it spelled unestimated loss in land value and annual crop production for the J. H. Beardslee and Michael Gleason estates just northwest of Montesano.

A survey by County Agent Arthur Kulin, shows that in Grays Harbor County alone, 242 acres of the best bottomland farms tumbled into the streams during the 1934-35 winter and spring rises. Hundreds of farms on the Coast are similarly damaged each year.

¹ Hydraulic engineer, hydrologic division, Soil Conservation Service, Washington, D. C. This article is based on field observations by the author and on data submitted by John A. Allis, project supervisor, hydrologic division, Central Great Plains Experimental Watershed, Hastings, Nebr.

LEGUMES FOR DEFENSE

FARMERS in the Holmes County and Montgomery County Soil Conservation Districts in north-central Mississippi are doing remarkably good work in harvesting legume seeds for cover crops and pasture. This is a real contribution to the Defense Program, because cover crops reduce the need for purchase of commercial nitrogen by the farmer. More nitrogen thus is available for munitions, and there is in addition a saving of transportation facilities in moving such fertilizer to the farms. Many southern farmers need to double and double again their present acreage of cover crops. They can do this most economically by growing their own seed. Many will not get it done and keep doing it unless they are doing it with home-grown seed.

By making their present pastures better and putting more badly eroded land into pasture, farmers not only will save soil, but will improve the food supply of the people on and off the farms in localities where too

little meat and milk are now available. Such improvements in nutrition constitute a vital part of the Defense Program.

The following quantities of seed were harvested by cooperating farmers in the Holmes County and Montgomery County Districts this spring:

Kind of seed	Amount of seed harvested	Number of farmers harvesting
White Dutch clover (clean).....lb..	21, 175	19
White Dutch clover (uncleaned)....lb..	330	38
Hop clover (uncleaned).....lb..	960	11
Bur clover seed saved on own farms...bu..	154, 210	64
Bur clover seed saved on another farm...bu..	3, 790	72
Crimson clover.....lb..	12, 060	7
Wild winter pea (<i>Lathyrus hirsutus</i>)...lb..	6, 000	2
Austrian winter pea.....lb..	300	1

WANTED: TECHNICAL ASSISTANCE ONLY

(Continued from p. 79)

argued. They did and he did. Now Jameson has some of the prettiest contour furrows anywhere and the new alfalfa-brome seeding is improving his old pasture of Canada bluegrass and quackgrass.

"It is not just the farmers who cooperate 100 percent," Rosencrans remarked. "The county highway people do, too. They have improved roads, seeding and sodding the roadside ditches, not only to handle normal run-off but to serve as terrace outlets."

As County Agent Hemstreet remarked, "Hungry cows trying to nip an existence from sunburned June grass pastures produce little butterfat and at high cost, compared to well-fed animals, knee deep in brome-alfalfa." That is why 600 farmers in the county planted alfalfa-brome last year alone; why, the year before, Grand Traverse County planted 6,000 acres of alfalfa-brome and more than 4,000 acres of other legumes and perennial grasses; why farmers used 66,329 pounds of 16-percent phosphate, 23,600 pounds of 50-percent potash, 164 tons of lime, and 4,000 cubic yards of marl.

These Michigan fruit growers have changed their pattern of planting and tilling. They once said that young fruit trees could not be started in sod and mulch.

They clean tilled them—and had erosion. Now their young orchards, contoured, terraced, and green with sod, apparently are growing well. Old established orchards, which may stand for years, are kept covered with grasses, legumes, and mulch. All vegetable matter is disked into the soil because, like steel-reinforcing in concrete, organic matter binds the soil and gives it more moisture-holding capacity.

Farmers from neighboring counties have come to see what is going on in Grand Traverse. They are talking about forming soil-conservation districts. But Grand Traverse is a jump ahead of its neighbors: with their old project demonstrations to guide them, they already have voted in favor of organizing a district and are now developing their work program.

Less than 3 years ago these Grand Traverse fellows asked for and got the first Soil Conservation Service demonstration project in which only technical guidance was furnished by the Government. They have made good on their end. As Roy Hooper, chairman of the county agricultural planning committee, said:

"We're all good farmers at heart. We want to farm the right way. We want to know how—and this soil-conservation project is showing us."

SUGGESTIONS FOR PASTURE MIXTURES TO MEET VARYING CONDITIONS

I

Q.—I want to establish a soil-conserving, profitable pasture in the northeastern part of the United States. What type of mixture shall I use?

See the map for the five main pasture regions of the United States and subdivisions of these regions (dotted lines) indicating more definitely the conditions under which each of the tame grasses or legumes is useful in pastures.

Know the soil conditions of the field where the pasture is to be established or renovated. What may suit one farm or field may not suit the adjoining farm. The upper part of one field or pasture often requires different seed as well as fertilizing and tilling to prepare the seedbed. Hence the mixtures given here should be considered as guides and used where specific recommendations for local needs are not available.

Plant a mixture of several kinds of plants, especially grasses and legumes, for a permanent pasture.

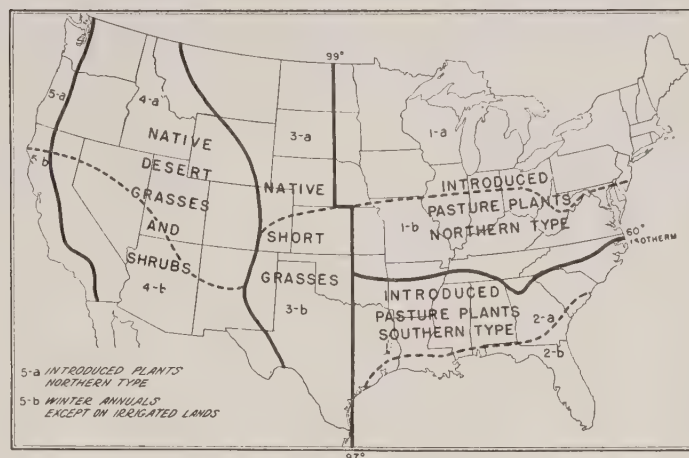
NORTHEASTERN STATES (section 1-a)

Mixture for good, well-drained soils:		Pounds per acre
Kentucky bluegrass	5 or 6	
Orchard grass	4 or 5	
Timothy	4 or 5	
Redtop	2 or 3	
Alsike clover	2	
Red clover	2	
White clover	1 or 2	
Total	20 or 25	

Mixture for poor, well-drained soils:		Pounds per acre
Orchard grass	8 or 10	
Canada bluegrass	5 or 6	
Redtop	4 or 5	
Alsike clover	2 or 3	
White clover	1	
Total	20 or 25	

In Iowa, Minnesota, and the Dakotas, bromegrass may be substituted for orchard grass in the above mixtures.

Mixture for wet, poorly drained soils:		Pounds per acre
Timothy	4 or 6	
Redtop	8 or 10	
Alsike clover	3 or 4	
Total	15 or 20	



Mixture for extremely wet, poorly drained soils:

Reed canary grass	5 or 8
Redtop	4
Alsike clover	1 or 3
Total	10 or 15

Pounds per acre

On land likely to be submerged for a part of the year, reed canary grass may be sown alone at the rate of 8 to 12 pounds per acre. Excellent pasture may thus be obtained from land otherwise unproductive.

NORTHERN CORN BELT

Mixture for short ley pasture (good, well-drained soils):

Alfalfa	10 to 12
Smooth bromegrass	6 to 8

Pounds per acre

SOUTHERN CORN BELT

Mixture for short ley pasture (good, well-drained soils):

Orchard grass	8 to 10
Korean lespedeza	15

Pounds per acre

NORTHEASTERN STATES

Mixture for short ley pasture:

Timothy:	
Fall seeding	5 to 6
Spring seeding	8 to 10
Ladino clover	2 to 4

Pounds per acre

Mixture for short ley pasture, more permanent seeding:

Alfalfa	6
Ladino clover	2

Pounds per acre



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

FIVE ACRES AND INDEPENDENCE—A PRACTICAL GUIDE TO THE SELECTION AND MANAGEMENT OF THE SMALL FARM. Revised and Enlarged Edition. By M. G. Kains. New York, 1940.

There are moments, in times such as these, when it is a tremendous relief to find a quiet small corner with only one's own small affairs for company. To many Americans this book provides the means for such relief. It is designed especially for people haunted by the small-country-home dream, yet it is nonetheless valuable to the established farmer, small or big, who knows that he should check the efficiency of his farm operations frequently and in detail. The meticulous care with which the author treats the details involved in intensive farming is most unusual and commendatory. As for soil conservation, every phase of it is here, from soils studies to farm planning, hillculture to agricultural engineering, plant propagation to the ecological relationships of soils and plants, climatic influences, tillage and fertility, and so on all along the road to successful farm business. The friendly, conversational tone of the book is one of its best features.

The author begins with a warning, by pointing out in no uncertain terms the "tried and true ways to fail" at intensive farming. He ends his book with appendices to the number of 46, compiled as ready helps to farmers looking for tested and approved methods of choosing, setting out, growing and harvesting a great variety of plants; retaining soil fertility; controlling pests; drainage needs and installation; fertilizer mixtures; cisterns, weirs, tools, septic tanks; run-off and erosion check-ups; cold storage. In between the "warnings" and the "helps" are 46 chapters dealing with practically every phase of farming the small farm for profit.

In books for actual use as "tools," especially in farming, one wants proved and up-to-date facts and not fish stories. One excellent way of checking the accuracy of such books is to check the author's experience and connections. M. G. Kains has been a farmer all his life, on many different farms and under varied conditions. He is likewise a horticulturist of note and has had wide experience as editor of horticultural, agricultural, and botanical writings. He is the author of other books on plant propagation, herb growing, and garden plants. He is, at present, special crop culturist for the United States Department of Agriculture.

As a test of thoroughness, I have gone through this book several times, each time with a different problem in mind. For example, this question came to mind: What are the points I should consider in choosing a small farm if it is my purpose to go into market gardening? Before I knew it I had more than 50 items, all of them important to the objective—and all classifiable under one heading or another of soil-conservation and land-management objectives, if one wanted to go more deeply into the analysis.

Other queries can be answered similarly and in even more detail: What are the precise directions for building up and maintaining soil fertility while using continuously every acre of the small farm for cash production? What about water supply, drainage, sewage, frost damage prevention, weeds, tools, fertilizers? Suppose I need

coldframes and hotbeds? A greenhouse? Can I keep any live stock other than poultry and bees? Since green-manure and cover crops are essential for improvement of the soil, how shall I determine the legume, or the mixture, best adapted to my soil and slope and climatic conditions? What cropping systems shall I use to avoid "sick soil?"

Suppose, then, that you have selected your small farm and have planned your soils management and tillage, and you know quite well your income needs. There may be a neglected orchard—in this book you will find several chapters on remaking such an orchard, fruit tree pruning, grafting, and the growing of new trees from nursery stock. Your vegetable crops, or your strawberries, or your bush fruits or grapes, or all of them—"something to sell every day"—will constitute your gardening-for-money objective. Mr. Kains offers you 11 chapters for constant use, once the go-ahead sign has been turned on. The first is about vegetable crops to avoid and to choose; then come most meticulous directions for seeds and seeding, transplanting, how to grow plants for sale and sell them, strawberry culture, bush and cane fruits, growing grapes for market, orcharding, storage of fruits and vegetables, and spraying and dusting.

There are about a hundred drawings, covering everything from indoor and outdoor fruit and vegetable storage systems to a diagram showing losses of lime through different crops and drainage.

CALIFORNIA FARM HANDBOOK 1941.

Compiled by the U. S. Department of Agriculture and the University of California. Superintendent of Documents, Washington, D. C. 1941.

This handbook and 47 more like it, one for each State—and perhaps three more, one for Alaska, one for Hawaii, one for Puerto Rico—would make a valuable reference for almost everybody in the country. The California Farm Handbook makes a good start and a good model.

Probably it would be difficult to find a farmer, a State or Federal agricultural worker, a city businessman or an industrialist, who does not need to know at one time or another, or many times within a year, where he can go for accurate information on the availability of information having to do with one or more of the public services available to agriculture within his own or some other State. This 114-page book, perforated and ready to hang on the wall, is going to save a great deal of time for California farmers.

The handbook is as completely up-to-date as is possible in these rapidly changing times. It tells the user where to go for information on agriculture in defense, including such subjects as the food situation at home and abroad and the outlook for increasing production of certain food crops, the best soil-conservation methods for wartime production, farm labor needs, registration for skilled work in defense industries, financial assistance, agriculture educational facilities, debt adjustment—and more than a hundred other problems from general programs to the details of actual farming processes and methods.

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



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¹ From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



W

EST OF THE FERTILE prairies, from Canada to the Mexican border, stretch the Great Plains. Among the short grasses of this vast area, few areas important as blue grama (*Bouteloua gracilis*). This valuable grass ranks in usefulness above all other members of its genus, although side-oats grama, hairy grama, black and Rothrock gramas are valuable range grasses of the West. A dense root system, extensive suckers, a perennial nature, and a habit of growing as a sod or bunch grass, combine to give this plant outstanding erosion-control qualities. It is adapted to a wide range of climate and a variety of soils, and is highly palatable to all classes of livestock. The curved, compact spikes of flowers are a useful wildlife food, and the gramas as a group are eaten by some 30 kinds of wild mammals and birds, in some places forming important elements in the diet of scaled and Gambel quails. For the coming year the Soil Conservation Service plans to use, generally in mixture with other adapted grasses, nearly 200,000 pounds of blue grama seed for revegetating range and farm lands of the Great Plains.—EDWARD H. GRAHAM.

DISTRIBUTION
OF BLUE GRAMA
(*BOUTELOUA*
GRACILIS)

MAJOR
DISTRIBUTION

MINOR
DISTRIBUTION





OCTOBER 1941

The Story
of
Ed Ogg

S OIL CONSERVATION

M. Clifford Townsend, who directs the Office of Agricultural Defense Relations, discusses the defense responsibilities of the Department of Agriculture. The Department, as he remarks, is "the point of assembly to which the Nation's farmers may bring their problems for solution." Page 97.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

A New Crop for the Old Farm:	Page
<i>By William C. Pryor.....</i>	89
Man, Land, Opportunity and Management— Success:	
<i>By Charles G. Webb.....</i>	94
Agriculture's Clearinghouse for Defense Activities:	
<i>By M. Clifford Townsend.....</i>	97
Farm Machinery and Farming Methods in Soil Conservation:	
<i>By L. S. Cutter and R. A. Norton.....</i>	100
The Valimont Farm:	
<i>By D. G. Craig.....</i>	107
Building a Soil Conservation Program Through Group Activities:	
<i>By John W. Ford, Jr.....</i>	110
Suggestions for Pasture Mixtures. (II. East-Central United States).....	111
Book Reviews and Abstracts:	
<i>By Phoebe O'Neill Faris.....</i>	112
For Reference:	
<i>Compiled by Etta G. Rogers.....</i>	Opposite 112

Front and Back Covers
by Bernard L. Simmons

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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A NEW CROP FOR THE OLD FARM

By WILLIAM C. PRYOR¹

IF YOU hear them talking down South about crop rotations of bass-bass-corn-alfalfa, don't be alarmed—they're fixing to grow a new crop on the farms in Dixie.

This new crop, believe it or not, is fish!

It sounds like a big jump, from cotton to carp, but that's what they are figuring on. And it fits right in with home production of foodstuffs, considered so important in complete conservation farming, and in the "food for defense" program and the fight for better nutrition in America.

Eventually, they hope, fish will become a new cash crop for the South—one which, under the rotation system, will improve the land instead of exhaust it as cotton, corn, and tobacco have done. A year or two of flooding a field between other crops should be very good for the soil.

In the meantime, some southern farm families are eating a little better than they used to—because in addition to pork, black-eyed peas, okra, and other vegetables they also may have as a regular part of their diet fish from their own "gardens."

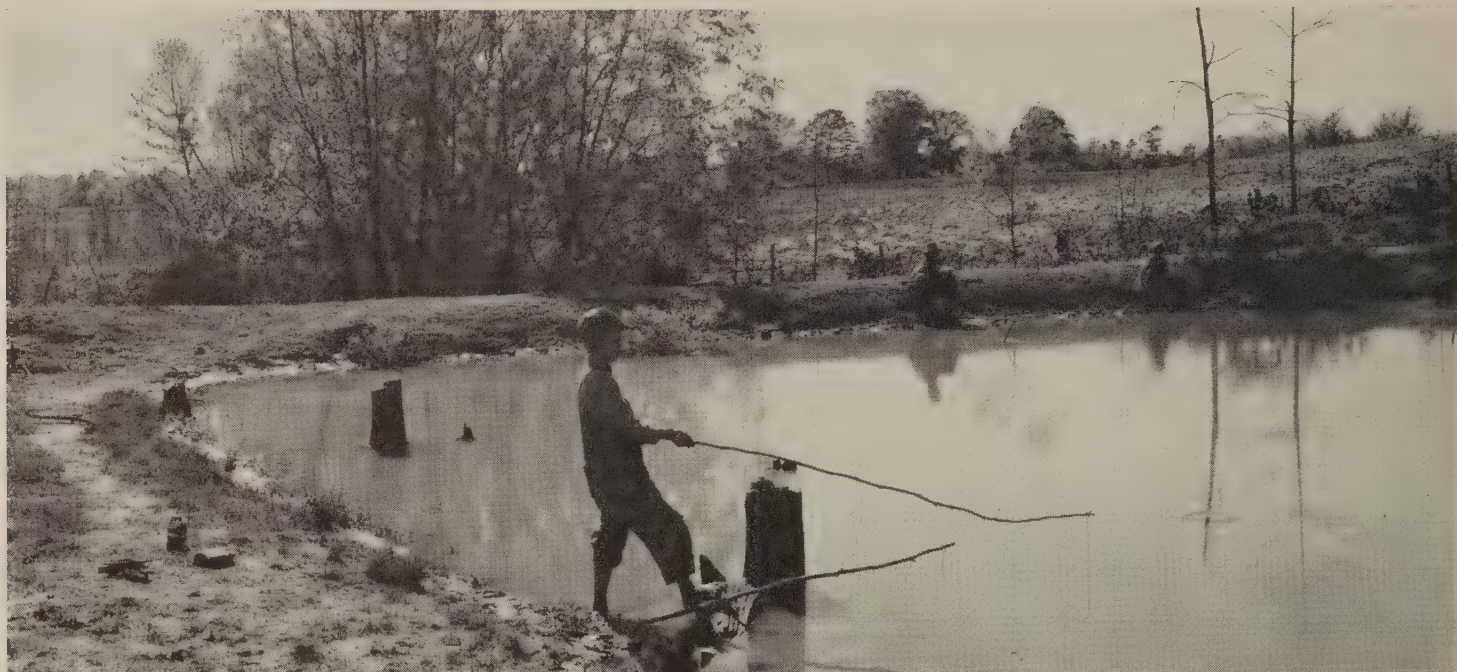
It is by no means a new idea, this production of fish on the farms and the rotation of fish and grain

or other vegetative crops on the same land. Farmers in many parts of France have been doing it for centuries. But it is relatively new in the United States, so new that although the purely experimental work is completed, it is still in the proving stage.

It all started about 8 years ago. Dr. H. S. Swingle and Dr. E. V. Smith, of the Alabama Agricultural Experiment Station, were members of a fishing club at Auburn, Ala. This was a good club. It had a good membership and a fine, large pond to fish in. In fact, it had everything—except fish. And no matter what club officials did, no matter what recommendations of what Federal and State experts they followed, the result still was the same: No fish they could brag about to other anglers, no fish worth mentioning, even. So Dr. Swingle and Dr. Smith decided to see what they could do.

After planning and discussion, a farm fish pond project was set up at the Alabama Agricultural Experiment Station and Swingle and Smith went to work. It is common knowledge among biologists that one of the basic diets of aquatic animals is plankton, the mass of floating organisms, both plant and animal, that live in water, so Swingle and Smith started with the plankton.

¹ Information Division, Soil Conservation Service, Washington, D. C.
412223—41—1



Many young fish live largely on phytoplankton, floating microscopic plants which are classed as algae, and so do the minute crustaceans and water insects which are found in practically all bodies of water. Larger fish live on smaller fish, on the insects and crustaceans, and to less extent on the phytoplankton. So Swingle and Smith reasoned that the supply of phytoplankton was the key to the situation.

Since the phytoplankton is composed of plants, they felt that it might be worth while to try fertilization in order to increase production of this basic food.

Laboratory experiments were carefully charted and carried out; as a result they learned that 6-8-4 commercial fertilizer plus some additional nitrate of soda was the best way to increase growth of phytoplankton. After that they started field experiments in a series of 20 ponds on the Experiment Station grounds. Then they found that 100 pounds of 6-8-4 and 10 pounds of nitrate per acre of surface water is the proper amount of fertilizer to get the best results. The amount can be increased up to eight times the recommended amount without danger, but more than that is likely to result in so much phytoplankton that fish production is set back.

What happens is that when the microscopic plants increase to such extreme numbers, they start to decay, using up so much oxygen from the water that there is not enough for the fish and for other animal life on which the adult fish largely subsist.

Fertilization is usually started about April and stopped about October. Fertilizers are applied simply. They are merely thrown into the pond from the edge, and analyses show that the plant nutrients are generally completely absorbed within 24 to 48 hours.

Fertilizer is applied to the fish pond as often as needed, and you can tell when it is needed simply by looking at the water: if you can see the bottom of the pond in a foot and a half of water near the shore, there isn't enough phytoplankton. If, on the other hand, the water is a murky green with these microscopic plants so that you *can't* see the bottom, then there's enough.

Of course, you have to "plant" your pond with fish, too. Experiments in Alabama have been carried out mainly with bream and bass, although carp has been tried successfully too. Ponds are stocked with 1,500 bream and 100 bass to the acre of water surface. Farmers may obtain fish to stock their ponds from the United States Fish and Wildlife Service or perhaps from State conservation agencies, although some States do not furnish fish for private ponds. Soil conservation districts often can work out advantageous arrangements for obtaining fish for a number of co-operators from the Federal Service which allows certain priorities to agencies cooperating with the Government.

Ponds stocked with 1,500 bream and 100 bass to the surface acre, during the Swingle-Smith experiments, were found to produce annually from 500 to 600 pounds of fish per acre, at a cost of around 3 to 6 cents a pound. And where can you buy beef that cheap?

Incidentally, 500 pounds of fish per acre per year isn't hay. In the Les Dombes region of France where farmers have been following the fish and grain rotation for at least four centuries—it was well established when the first written account appeared in 1570—interesting records have been kept.

On one representative pond of 450 acres, fish production was 146 pounds per acre annually from 1850 to 1880, and since 1880 it has averaged 164 pounds per acre. Beef production on pasture in the same area has averaged only 149 pounds per acre per year.

And here is a word of warning: Don't stock a pond indiscriminately as to number or species of fish. If

1,500 bream and 100 bass are good, it doesn't necessarily follow that 3,000 bream and 200 bass, with perhaps a few catfish thrown in, will be twice as good. If there are too many fish and too many species there will not be enough food, and most of the fish will not grow to worthwhile size. Bass 4 years old may be only 3 or 4 inches long if there is not enough food for them.



Controlling a gully by damming the head, a practice recommended in many parts of the country, produces a pond capable of developing good fishing.



And now, about those "other conditions":

Let's take area and depth first: Experiments have proved that the Swingle-Smith system will work perfectly well on ponds anywhere from 1/130th of an acre—a mere 15 by 22 feet or thereabouts—to 30 acres or more! It is essential, however, that the ponds have an average minimum depth of 5 feet or more, since shallower ponds are too likely to become choked with submergent or emergent water plants. There should be as little shallow water as possible, and that only around the edges of the pond.

And that brings us to cleanliness: Shores of the ponds, at least in the Southeastern States, must be kept free from plant growth. The larvae of the malarial mosquito develop readily in shallow water, especially where they find shelter in plant material or debris. Larvae of other mosquitoes present a similar problem in other regions. Top minnows which feed on these larvae are unable to get them if there is any amount of such debris around the pond edge. If the edge is kept clean, the larger fish, such as bass and bream, will dispose of the mosquito larvae.

Hundreds of farms, of course, have ponds with few or no fish in them. The reason often is too many water plants. Well, you might not believe it, but the experimenters have found in their research that the same old 6-8-4 will solve that problem, too. To do this, you simply apply the fertilizer in the late fall and winter instead of spring and summer. What happens is this: Fertilization of the pond at that time of year produces tremendous quantities of filamentous algae, which cover the water weeds so thoroughly that the weeds are killed through lack of light and in a few weeks may be eliminated.

Another point is that the pond should have a drain. This might be needed, for instance, if it were necessary to remove some of the fish. A pond that is too crowded with fish is not productive, since none of the fish can grow to proper size.

The ideal way, of course, to keep the fish in the pond down is to fish the pond regularly, but few people do that. Dr. Swingle maintains that most fish-pond owners do not fish their ponds as thoroughly as they should.

Fish, it seems, are now a farm crop, and this crop should be harvested as regularly and thoroughly as any other perennial crop, if you want to keep the crop coming on. If you "harvest" all the fish you can each season from your pond, the ones remaining in the pond at the season's end usually will be in the proper balance to produce the same quantities of fish the next year. Nature, with her invariable processes, takes care of that.

Bass, of course, will keep the bream down to some extent, but bream reproduce on an amazing scale and the bass can't do it all. So removal of bream by fishing is necessary, and likewise removal of bass, although, left to their own resources, bass have not multiplied so rapidly.

Now, if using 6-8-4 to grow a crop of bass still sounds like a "fish story" or like something from one of Walt Disney's Silly Symphonies, look at these "case histories."

In one particular pond, a total of 1,580 bream had been caught in the 5 years prior to fertilizing; in the first 6 months after fertilization, 1,612 bream had been caught and by the end of the first year, 2,038 bream. In the same 5 years before fertilization, the catch had been 1,506 catfish, and in the first year afterward, 1,762 catfish were taken.

There is another pond near Auburn, a 12-acre one, which is fished by 60 families, and each family has all the fish it can use from that pond during the year at a cost of \$13 per family per year. Careful study of the records, according to Dr. Swingle, indicates that the pond, however, is not being fished to capacity.

"Twice as many," he says, "a hundred and twenty families—could fish that pond regularly, and get as much as they wanted, and the cost would be cut and there would actually be better fishing from it."

Drs. Swingle and Smith are not satisfied with their results. They are continuing their studies. They hope to improve bass fishing, possibly through addition of another species to the bream-bass combination.

They hope to discover a fish which can be profitably used for commercial production on the farm—a new "cash crop."

They hope also to modify fertilizers so as to reduce cost, and they are studying the renovation of old ponds which cannot be drained.

Application of the Swingle-Smith system in other parts of the country will present, of course, other problems, which will have to be tackled by scientists in those other regions. One of these problems is the effect of climate. Slightly lower temperatures and shorter growing seasons in Northern States may affect production, although there now seems to be no reason why the principles established by the Alabama researchers should not apply anywhere in the country, subject to regional variations.

Water pollution, as in industrial sections, and excess alkali, as in certain parts of the west, of course would have to be avoided or corrected.

The effect of mud and silt will need to be studied, too. In the region where the Alabama experiments



In ponds that are too shallow, emergent water plants may develop, effectively preventing fish production.

have been conducted, soils have been largely sandy with a resultant minimum of silt, so that problem has not been encountered in serious proportions.

The value of what Drs. Swingle and Smith have done, and the importance of continuing the study, however, is readily apparent.

Diet deficiencies are especially evident in the Southeast, but they exist everywhere and with startling frequency on farms. More production of foods rich in proteins and other elements is being urged upon the nation.

Increased intake of proteins would be of great benefit to the rural South and to a large segment of the nation's population. Fish are a rich and valuable source of proteins and phosphorus, and at a production cost of 3 to 6 cents a pound are certainly one of the most economical. Fresh-water fish also contain small amounts of vitamin B₁ and riboflavin, known as vitamin G; iron, and calcium; potash, and water.

Obviously, farm fish ponds as a supplementary food source have tremendous possibilities. From the standpoint of the rural sportsman they have still another value.

They are considered so important from the standpoint of a well-rounded conservation program that the Soil Conservation Service has established a number of demonstration ponds and is including fish ponds in many farm plans in the South.

Viewed as a commercial production proposition—a new dual-purpose crop, which may eventually be used in soil-enriching rotations with grain or forage crops—they assume a new importance in the program to make farmers of the South and of the nation more self-sufficient through conservation farming.

POSTSCRIPT TO "SNOW WATER"

Interesting in connection with the article, Snow Water, in the July 1941 issue is a paragraph in a recent letter from A. T. Mitchelson, acting chief, division of irrigation, Soil Conservation Service, Berkeley, Calif., to M. L. Nichols, assistant chief of the Service, in charge of research. The letter pertains to storage in the Elephant Butte Reservoir. Writes Mr. Mitchelson:

"You will note that the actual river discharge into the reservoir was only 1 percent out of line with the forecast made by the division in our snow survey work. You will appreciate this more fully, I am sure, when you realize that this Elephant Butte forecast was a result of a special survey made after the close of the regular snow season and because of the anxiety of the State officials and the Bureau of Reclamation engineers regarding spill from the reservoir."

The forecast of storage was 1,941,000 acre-feet, which, as stated, was "only 1 percent out of line."



Ed Ogg believes the sorghum strip helps to protect the corn at the right from chinch bugs.

MAN, LAND, OPPORTUNITY AND MANAGEMENT—SUCCESS

By CHARLES G. WEBB ¹



Ed Ogg and old Molly, who is mother, grandmother and great-grandmother of the cattle owned by Ogg. They are standing in outlet channel sodded to Bermuda grass.

GIVE a man or a piece of farm land a chance and both will make good. That is the opinion of Edmond A. Ogg, 45-year-old Muskogee, Okla., tenant farmer and erstwhile WPA laborer. In the past 6 years, lanky, lean, and hard-working Ed Ogg has proved his opinion sound.

By the standards of many, Ed Ogg still is not financially well-to-do, nor is the 140-acre farm he operates a soil and water conservation show place; but both the farmer and the farm have progressed—the farmer away from relief labor to security and independence, and the land from serious soil erosion and misuse toward conservation and wise use. Today, with confidence, Ed Ogg is seeking a larger farm that he can operate under a complete soil and water conservation system. He wants a farm with its cultivated land protected from erosion by contour cultivation, strip crops, terraces, and good crop rotation—a farm with lush Bermuda grass and clover pastures where old Molly, Jersey matriarch of his herd of 19 cattle, can grow fat and contented—a farm that will produce all the feed needed for his cattle, work stock, hogs, turkeys, and chickens. He not only wants this farm, but

he expects to find it, or to help create it with his own labor.

Six years ago Ed Ogg and his stepmother who manages his home for him did not have cattle, horses, mules, hogs, turkeys, and chickens. They did not have a cotton crop, good for 15 bales on 24.6 acres, or corn that will average 16 bushels to the acre in spite of heavy rains—he planted some of the corn crop four times before he got a good stand. Back in those days—in 1935 when he and his stepmother moved to Muskogee County—Ed Ogg had only old Molly, the grade Jersey cow now 9 years old, an old truck, and \$35 in cash. It took \$17 of the \$35 to register the truck; and old Molly was in the keeping of a brother near Tulsa. Thus, actually, Ed Ogg had only \$18 in cash and the truck, plus a willingness to work and a determination to get ahead. He worked, worked hard as a WPA laborer in the rock quarry for the Soil Conservation Service demonstration project in the Pecan Creek watershed near Muskogee. He lived in a small house on the W. C. Stone farm which was under a soil and water conservation agreement with the demonstration project. He paid the rent on the house by working 2 days a month for Stone. He remained on relief work during 1936, when old Molly was moved to the farm on which he was living.

In 1937—and here the Ogg fortunes began to look upward—Ed Ogg rented 50 acres on the J. R. Parks farm for \$50. He continued as a WPA worker but he had been advanced from laborer to grader operator. He hired a neighbor's team to cultivate his crops which yielded 5 tons of hegari, 125 bushels of corn, and one-half bale of cotton. In the meantime

¹ Associate information specialist, Western Gulf Region, Soil Conservation Service, Fort Worth, Tex.

he had obtained the foundation for a flock of chickens by buying 100 chicks. Late that autumn he gave up the Parks farm—rented another 80-acre farm and bought the team and the farming tools of the previous tenant by assuming a \$127.50 note at the bank. He became a conservation farmer in 1938 when he assumed the responsibility for carrying out the 5-year conservation agreement on this farm with the Pecan Creek watershed project.

Ogg recalls that little conservation work had been done on the farm when he went there. He constructed terraces, established strip crops and adopted rotations which included sweetclover and cowpeas. He constructed and helped to sod to Bermuda grass an outlet channel emptying into the 5-acre pasture on the farm. Although he made no especial effort to establish Bermuda grass in this small pasture, today a considerable stand of it can be seen there—Ogg said he would have mowed the pasture had he owned a mower.

In 1938 Ogg harvested 300 bushels of corn and 7 bales of cotton from the 44 acres of cultivated land. He bought a team of bred mares and traded a .22 caliber rifle for a purebred Poland-China gilt. With the exception of his salary during 4 months' work as a WPA grader operator on the demonstration project, all of his income during 1938 came from the farm.

The following year, Ogg rented an adjacent 60-acre farm, which gave him 56.6 acres of additional cropland. His harvest that year was 300 bushels of corn, 15 bales of cotton, 28 tons of prairie hay and 170 bushels of oats. By the fall of 1939 his inventory showed 13 dairy cows, 10 hogs, 3 mares, 3 colts, 1 horse, 10 turkeys, and 100 chickens. He had obtained the turkeys by trading 2 bushels of cottonseed for 20 turkey eggs. From August 12 to November 12 that year, he marketed \$116 worth of chickens, eggs,

and cream—an average of nearly \$40 per month.

In 1939 conservation farming practices were established on the additional rented land. Some of the first channel-type terraces constructed in the Pecan Creek watershed were on this land.

Misfortune dogged Ogg's steps in 1940 when mid-summer hail destroyed his entire cotton and corn crops. He did not gather a pound of cotton that fall. Two days before the hail, however, he had finished threshing a 1,236-bushel oat crop, and this together with the accumulation of livestock served to cushion the loss. He sold four surplus work animals to pay off all except \$154 of his loan at the bank. The sale of livestock and livestock products made it possible for him to produce his 1941 crop. Between January 1, 1941, and mid-August, the sale of cream averaged about \$10 per week, Ogg estimated; and during August, when eight cows were being milked, the weekly cream check ranged from \$12.50 to \$13. He also had sold four 6-weeks old pigs for \$40 and four 6-months old pigs for \$80.

Today the former WPA laborer has livestock which he values at \$1,200. This includes 19 head of cattle; 4 grown work animals; 3 young work animals; 2 brood sows, 2 hogs that will be slaughtered this fall, and 8 pigs; 250 White Leghorn chickens, and 60 turkeys. His crops this year are 45 acres of corn, 24.6 acres of cotton, 2 acres of cane, 8 acres of hegari, 2 acres of black-eyed peas, 5 acres of sweetclover in strip crops, and 2 acres of lespedeza.

Ogg has carried out a conservation farming plan to the best of his ability under circumstances which might have defeated a less determined man. He has been handicapped by lack of equipment. For example, he sowed the 5 acres of sweetclover strip crops by hand. He has not had a mower with which to improve



Here we see the subject of this article among his cows, pigs, and poultry.



Ed Ogg, Oklahoma farmer.

the pasture. A major obstacle to his livestock program was the lack of water. Since Ogg went to this farm in 1938 he has had to haul water approximately 1 mile for the livestock.

This tenant farmer recently has been seeking another farm because 80 acres of the land he has been operating has changed ownership. Ogg believes that the land brought a better price for having received conservation treatment. His landlord once said that conservation practices had increased the value of the farm \$1,000.

"I don't want to rent anything except a conservation treated farm or one the owner is willing to help me protect from erosion and build up," Ogg said. "I just turned down a 480-acre farm that I could have rented. It had good barns, good water, and the owner was willing to spend \$200 or \$300 on the house, but the land was washing away.

"I want to make my own pastures with clovers, lespedeza and Bermuda grass and fertilizer, and I want to keep the soil in the fields and make it better soil."

Ed Ogg is convinced that there should be the closest cooperation between landlord and tenant in establishing and maintaining a conservation farming system.

"You can't expect to get conservation on the land if the landlord and the tenant want to get every

dollar they can out of the land and not put anything back," he declared. "The tenant should have an opportunity to build up the land with clovers, peas, lespedeza and by spreading manure. If you give the land a chance it will come back, and if you give a man a chance he will make good."

Just as this article goes to press, word comes that Ogg has rented a 160-acre farm near Muskogee, Okla., in the Muskogee-Okmulgee Soil Conservation District. The owner has observed Ogg's work during the past 5 years and offered to rent the farm to Ogg as soon as he learned the tenant would have to move.

The farm has no conservation practices on it now. It will be placed under agreement with the district, and Ogg will receive every cooperation from the landlord in carrying out the conservation plan. The rental agreement is the customary 1-year, third-and-fourth lease (one-third of the feed crop and one-fourth of the cotton to the landlord). However, Ogg and the owner have a verbal agreement that if the landlord-tenant relationships are satisfactory the first year, they will enter into a long-term agreement for the operation of the farm for the production of livestock. Under such a plan, Ogg would have a one-half interest in the livestock and would benefit most from the conservation program.

DISTRICT PLANS FOR WILDLIFE

In the near future, farmers cooperating with the Fenton Soil Conservation District in Michigan may have a detailed wildlife management plan for their farms, as well as general soil erosion control plans. This is by virtue of an understanding with the directors of the Fenton district under which the Michigan State Conservation Department prepares the plans for wildlife management.

Early last spring, J. H. Skinner, chairman of the Fenton district, reported that 26 wildlife management plans had been drawn and included as a part of the district agreements with farmers.

The Fenton district embraces a portion of the old Livingston County soil and water conservation demonstration project. This area, as well as adjoining areas within the district boundaries, is endowed with many natural lakes and marshlands. Moreover, the countryside is spotted with small woodland patches, hedgerows, stone fences, and clumps of shrubbery—all conducive to excellent wildlife habitats. To offset these natural wildlife advantages, farmers have permitted some "burning over." Also, the area is surrounded by numerous cities, whence come many hunters. Biologists know that wildlife needs encouragement.

AGRICULTURE'S CLEARINGHOUSE FOR DEFENSE ACTIVITIES

By M. CLIFFORD TOWNSEND

Director, Office of Agricultural Defense Relations, United States Department of Agriculture

WHEN the President set up the National Defense Advisory Commission in May 1940, he very properly included a representative for agriculture among the seven commissioners named. At that time, there was no lend-lease bill. At that time, our defense program was a modest effort compared to the giant objectives on which we now have set our sights. At that time, this Nation had not yet awakened to the full peril of the Hitler menace.

At that time, agriculture looked at its overflowing elevators, bins, and warehouses, at the new surpluses piled up by the loss of foreign markets, at its great productive plant, and decided that from the viewpoint of national defense and national safety, American farmers were more than prepared to meet the emergency. And I believe they were right—at that time.

But in this war-torn world of "blitzkrieg" tactics and double-crossing statesmanship, the picture changes rapidly and as it does, so do our national responsibilities. As things grew darker overseas, we were forced to recast our entire defense effort. In December 1940, the President set an even greater goal for the defense program than just the rearmament of the United States when he pledged that this country "must be the great arsenal of democracy."

To help meet this additional demand, the President, in January 1941, enlarged the administrative structure directing the defense effort by creating the Office of Production Management, and providing for the coordination of the activities of the National Defense Advisory Commission, the OPM, and other defense agencies through the Office for Emergency Management. The OEM was designed to serve as the extra eyes, hands, and brains of the President, and in this set-up the agricultural representative on the National Defense Advisory Commission continued to function.

With the passage of the lend-lease bill and the inclusion of agricultural products in the list of supplies to be made available to the nations resisting aggression, it soon became apparent that agriculture had an "action" part to play in the defense program comparable to that of industry's. Unlike industry with its trade associations and comparatively few producers, unlike

labor with its unions and collective bargaining system, agriculture has no national nongovernmental unity embracing each of its 6 million farms except that inherent in programs administered through the Department of Agriculture.

The Department has been the natural place, the point of assembly, to which the Nation's farmers may bring their problems for solution. The Department works with farm organizations and with unorganized farmers; with the one-horse man and the tractor owner; with the farmer as a producer and with the farmer as a consumer.

This work has been implemented in the last 8 years by the setting up by Congress of the legislative machinery whereby all of the Nation's farmers can unite in national agricultural programs. That machinery, including, among other agencies, the Agricultural Adjustment Administration, Soil Conservation Service, the Farm Security, Surplus Marketing and Rural Electrification Administrations, all operates through the Department of Agriculture.

Thus it was that when agriculture's job in defense shifted to an "action" basis, the President made the logical move when, on last May 5, he transferred to the Secretary of Agriculture those functions that previously were assigned to the National Defense Advisory Commission. In transferring the duties, he asked that an "Office for Agricultural Defense Relations" be established within the office of the Secretary of Agriculture.

In his letter to the Secretary, the President said:

MY DEAR MR. SECRETARY: As emergency defense activities continue to develop and expand, I am deeply concerned that adequate provision be made for the correlation of agricultural operations with other elements of the national defense program. Up to the present time, the principal responsibility for bringing agricultural activities into proper focus in relation to defense has been vested in the Division of Agriculture of the National Defense Advisory Commission. With the aim of further strengthening the emergency organization for defense, I believe it now desirable to place these special defense activities directly in the Department of Agriculture where they will be brought closer to the established agricultural programs of the Government.

Accordingly, I am placing in the Department of Agriculture, effective May 5, 1941, those functions which were previously assigned to the Division of Agriculture of the National Defense Advisory Commission. To provide for the conduct of these func-

tions, it is my desire that you establish within your immediate office an "Office for Agricultural Defense Relations." This Office, directed by a responsible official and consisting of a small group of policy and liaison persons, should not only continue those activities previously performed by the Division of Agriculture but should also assist you in carrying out the defense activities now located in the Department.

In requesting the creation of this Office, I am taking the position that, broadly conceived, the most vital operating functions of agriculture in the defense program, are first, the guarantee of an adequate supply of food for the needs of this Nation and supplemental needs of those nations whose defense is essential to the defense of this country; and second, the provision of sufficient agricultural raw materials for expanded defense production. In the accomplishment of these major purposes, it will be necessary to assure that the agricultural balance is not destroyed and that the consequent ability of the agricultural population to fulfill its contribution to the defense effort is not impaired.

With this concept of the role of agriculture in defense, I suggest that the Office for Agricultural Defense Relations perform the following duties under your supervision:

1. Serve as a clearing house to bring into common focus the consideration of agricultural needs and problems as they relate to the defense program;
2. Facilitate the coordination of defense operations carried on by the various bureaus and agencies of the Department of Agriculture;
3. Assist the Secretary in the maintenance of effective channels of communication between the Department of Agriculture and the several agencies of the Office for Emergency Management, the Departments of War and Navy, and other defense agencies, with respect to problems of procurement, production, priorities, price, and other activities involving agricultural considerations;
4. Assist in the planning of adjustments in the agricultural program in order to meet defense needs.

Even though located within the Department of Agriculture and responsible directly to you, this special Office should be considered an integral part of the emergency defense organization. In this role, the Office will be in a strategic position to work and cooperate with the several units of the Office for Emergency Management, the War and Navy Departments, and other defense agencies.

Very sincerely yours,

FRANKLIN D. ROOSEVELT.

Needless to say, we are attempting to carry out the wishes of the President and the Secretary to the best of our ability. We are not, however, attempting to carry out administratively any of the "action" programs. We are purely a planning, advisory, policy-making, liaison unit which serves as a clearing house for consideration of agricultural needs as they relate to defense. For example, we helped decide that increased production of soybeans for oil was advisable, but the actual carrying out of that program is a job for the Agricultural Adjustment Administration and the Commodity Credit Corporation.

In setting up our unit, we tried to make it small and at the same time broad enough to cover as many agricultural problems growing out of defense as we could foresee. We finally decided that most of our problems are likely to fall under four general headings—

production, farm equipment and supplies, rural labor, transportation and marketing—and with this in view we have set up four divisions to deal with these matters.

Our Production Division is responsible for securing from the Army, the Navy, the Purchasing Division of the Office of Production Management, and the various agencies within the Department, the military, lend-lease and domestic demands for agricultural products including food, fats and oils, cotton, wool and other agricultural fibres, forest products, certain drugs, and leather. It is this division's job to work with the various "action" agencies to adjust production and acquisition of these products so as to meet demand.

The Farm Equipment and Supplies Division is responsible for helping to secure priorities for agriculture. This field will include metals for farm equipment and for plants processing farm products; chemicals for agricultural uses, such as fertilizers, insecticides and fungicides; petroleum products and other materials needed to maintain the farm plant.

The Labor and Rural Industries Division is responsible for developing and planning programs, in cooperation with existing agencies, to assist in handling farm labor problems. This division also reviews and analyzes requests for the location of military establishments, and consults with the Labor Division of the Office of Production Management on all labor relations involving agriculture.

The Transportation and Marketing Division is responsible for securing transportation, warehousing, packaging and marketing facilities for agricultural products and supplies. It works in close cooperation with the Transportation Division of the Office for Emergency Management, the Interstate Commerce Commission and agricultural agencies.

That is a general picture of the OADR's physical set-up. In order to get the full picture of what is being done, however, it is necessary to look at agriculture's defense contributions as a whole without regard to agencies or bureaus. Even before the formal transfer of agriculture's defense responsibilities to the Secretary of Agriculture, the Department had launched a Nation-wide food-for-defense program.

That program is a part—one of the most important parts—of our all-out defense effort. Food is a defense weapon, one of the strongest we have. Without food, Britain and the other nations resisting aggression cannot continue to stand between the United States and the Hitler menace.

Under the plan, the Department of Agriculture has promised to support certain average prices for dairy products, hogs, chickens, and eggs. At the same

time, the Department intends to maintain feed prices at levels which should make profitable for farmers the conversion of our large feed reserves in the ever-normal granary into food for defense.

This whole general program for increased food-for-defense has been augmented and considerably stimulated since it was announced last April 3. We have discovered, for example, that the British need a large amount of dairy products. Concentrated foods that require less shipping space and less refrigeration are what the British need. This need, coupled with the food habits of the British people, naturally has led to a large demand for cheese, evaporated milk, and dry skim milk from the United States.

The production program also has been broadened to include more soybeans for oil; production of a supply of adapted castor bean seed for use if or when we have to supplement our normal imports with domestic castor bean oil, and similar variations to meet the apparent and prospective needs.

We are fully aware that in order to produce the needed farm products, agriculture must have the equipment, implements, and service to carry out its work. Consequently one of the most important jobs of the Office of Agricultural Defense Relations is to present agriculture's case before the defense officials who are responsible for granting priorities for metals, chemicals and other strategic materials. We soon discovered that this was largely a matter of understanding, and as soon as the priorities officials understood why agriculture needed certain things, we received the fullest sympathy and cooperation.

This sympathetic attitude does not mean that we can expect to get for agriculture everything we want or need. Priorities and rationing, which may be expected to expand greatly as our defense program develops, are already affecting poultry equipment, milking equipment, fencing, steel grain bins, tractors, and some farm machinery. Nitrates, the basis for explosives as well as for fertilizers, may be affected soon. Other chemicals and drugs for insecticides, fungicides, and disinfectants are likely to be short. The shortage of farm labor, the increased cost of things farmers buy, and all of the other things that make up a war-time economy must be faced by farmers planning for the future.

We can, however, be assured of one thing—that agriculture's vital part in the defense program has been thoroughly presented to defense officials. As a result, virtually all of agriculture's requirements were included in a list of 26 essential industries and services for which, on July 1, the Civilian Supply



M. Clifford Townsend.

Allocation Division of the Office of Price Administration and Civilian Supply established a priority status for repair and maintenance parts. This priorities order is designed to assure continued operation of essential industries and services which might otherwise be curtailed because of the inability to secure needed repair or maintenance parts.

The chief significance of the order is that it gives full recognition to the basic role agriculture is playing in the defense program. This is of prime importance, because many of the same strategic metals that go into a plane or a battleship are used to build or repair an incubator or a tractor.

To be assured of a sufficient supply of materials to repair and maintain the existing farm plant is in itself of great importance. Most farmers or their helpers have enough mechanical knowledge to make the normal, routine repairs necessary to keep farm equipment operating. If parts are available, the simpler farm machinery can, if necessary, be kept operating in this emergency by farmers and their hired labor.

In addition to the general priority order for repair and maintenance materials, specific cases of emergency preference ratings for agricultural needs have arisen.

(Continued on p. 111)

FARM MACHINERY AND FARMING METHODS IN SOIL CONSERVATION¹

By L. S. CUTTER and R. A. NORTON²

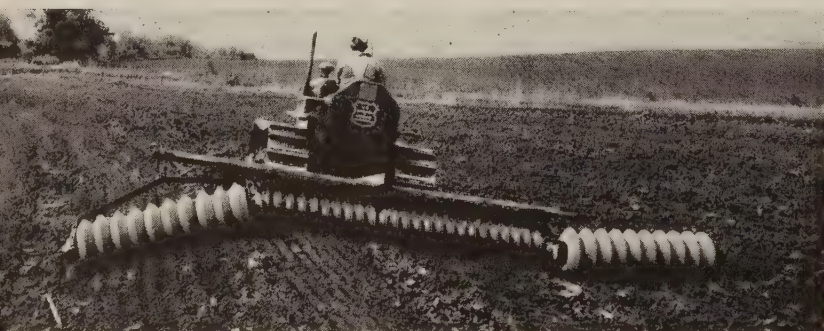
WHEN changes are made in tillage practices, it necessarily follows that some changes in farming equipment are advisable. With the application of conservation programs to farm lands during the past few years, farm operators have faced the problem of adjusting their equipment to fit the needs of changed conditions. One of the adjustments has involved the

¹ Cooperative research in soil and water conservation investigations, between the Office of Research, Soil Conservation Service, and Iowa Agricultural Experiment Station.

² The authors are cooperative agent (farm foreman), and project supervisor, respectively, Soil Conservation Experimental Farm, Clarinda, Iowa.



No. 1.—Main harrow doubletree carried by wheels at each end to avoid dragging down of terrace crown.



No. 2.—Land roller, showing the flexibility that may be obtained by using machines constructed in sections.



No. 3.—Four-row stalk cutter has the flexibility necessary to operate efficiently on terraced land.

introducing of flexibility into some of the machines to adapt them to rough and uneven ground such as terraced land. It has been proved also that some departure from conventional methods is desirable in plowing terraced land or land farmed on the contour. Difficulties such as these are perhaps not of sufficient importance in most instances to warrant discarding any particular machine in favor of an entirely new design. It is believed rather that only a few minor alterations or adjustments by the operator are necessary to adapt machinery already in use to the change in tillage operations.

The purpose of this article is to point out some of the minor changes in farm machinery that have proved helpful in farming the loessial lands in western Iowa, eastern Nebraska, and northwestern Missouri, under conservation methods. In addition, some of the farming methods used on the Soil Conservation Experimental Farm at Clarinda, Iowa, will be discussed.

Disking, Harrowing, and Rolling

In general, all tillage operations should be parallel to terrace ridges or contour lines. However, in disking cornstalk land, or harrowing for seedbed preparation, more efficient work frequently can be done by approaching these contour lines at an angle. This plan is used in disking and harrowing operations on the Soil Conservation Experimental Farm.

Flexibility is a very important factor in the disk, harrow, or roller for efficient operation while passing over terrace ridges. Disks most commonly used in this area are 14 feet in width and tractor drawn. Some are constructed in two 7-foot rigid sections, while others are constructed in four 3½-foot sections. The four-section disk provides added flexibility in passing over terrace ridges and channels.

For the same reasons, an 18-foot, four-section, flexible pipe bar drag harrow was selected for use on this experimental farm. The operation of this implement was satisfactory except that the doubletrees tended to pull down terrace ridges while passing over them, and the ends of the doubletrees would drag while harrowing parallel to the terrace ridge. This was overcome by constructing a main doubletree with wheels at each end as shown in photograph No. 1. In turn the harrow sections were attached to this doubletree, or cart, in pairs.

The land roller has been found to be very effective in preparing seedbeds for grass and legume seedings. It is important that this operation, either before or after seeding, be performed parallel to terraces or contour lines. By this method all depressions made by tractor wheels or rollers will tend to retard run-off. Photograph No. 2 shows a hookup that allows the roller to make good contact on uneven ground.

Cutting Cornstalks

In this area, stalk cutters were in common use before the disk harrow was developed. Physical discomfort to the operator caused by the uneven motion of this machine and sore necks and shoulders suffered by the teams, led to a decline in the use of stalk cutters. Many farmers turned to raking and burning their cornstalks; others substituted the disk harrow for this work.

However, in recent years, so much emphasis has been placed on the value of retaining crop residues that the stalk cutter is regaining popularity. It probably is superior to the disk for chopping up cornstalks, especially where a cover crop has been seeded in the corn the preceding fall. This is true because the stalks can be worked down without excess damage to the cover crop which can be left undisturbed until plowing time.

Most of the stalk cutters now in use are homemade,



No. 4.—Parts of a used fertilizer spreader have been adapted for use on this two-row lister planter. The attachment is power driven from the drive shaft in front of the operator, by use of a V-belt and auxiliary shaft.



No. 6.—The addition of a shield in front of the grain drill pushes the corn stalks away from the drill so that the stalks do not damage the drill spouts. Since most of the stalks are still fastened to the ground, bunching does not occur in front of the drill disks.



No. 5.—By rearrangement of the length of the segments of the power shaft in such a way that a knuckle of the shaft comes over the connection between the hitch and the drawbar, the binder is allowed to operate over terraces without damage to the power drive.

and are constructed to cover three rows by using the cutter heads from old horse-drawn machines, and setting them in a rigid wooden frame that can be pulled behind a tractor. Operators have found that the tractor-drawn machines do a more efficient job of chopping because of added speed. This three-row type of machine still has one disadvantage, however, in that one section will not make contact with the ground surface when passing over uneven ground or terraced land. The machine shown in photograph No. 3 has been designed to overcome this objection. It covers four rows at a time and, as it is constructed in two sections, all blades make contact with the ground surface. The power necessary to operate this machine is less than that required to operate a disk of equal width.

Plowing

In the Missouri Valley loess region, a large percent of the tillable farm land is rolling. Plowing is a very important factor in conservation practices in this area.

Before the emphasis on water and soil conservation, plowing usually was done by starting around the outside borders of the field and working toward the center. The furrow slice was turned up or down the hill depending on the contour of the land. In certain instances some planning was done so that a maximum of furrows could be turned down-slope.

Furthermore, the dead furrow (last furrow in the center) extended either with the contour of the land, or at right angles or any angle, depending on the topography of the field. The same conditions existed for the turning areas at the corners of the field. Many operators commonly finished the plowing job by plowing out the corner turning areas, entailing double travel on these portions of the field, and leaving dead furrows at these points. Many field gullies exist today that were caused by dead furrows or by corner areas that were "plowed out."

Figure 1 shows a field of about 25 acres that was being farmed as a unit at the time the Soil Conservation Experimental Farm was established in 1931. The contour lines of the land may be seen as well as the lines representing the direction of travel of the plow by the method common to the area at the time. Note that in some instances the dead furrow and turning areas crossed the contour or level lines at rather abrupt angles. This caused concentration of water at these points and if gullies were not started, at least excess erosion occurred at these points. A check of the original map of this farm reveals that the same general conditions existed in all of the other fields being farmed at that time.

The only practical means of overcoming this difficulty, with use of the ordinary plow, was to plow in lands that conformed more nearly to the contour, but this was only partially successful because half of the furrows still were turned downhill.

In the spring of 1935, the Soil Conservation Experimental Farm began using a two-way plow. This type of plow was in common use in other sections but probably not in connection with soil conservation work.

A one-bottom, tractor-mounted type of two-way plow was selected for use on this farm. It was believed that this type of plow had two distinct advantages over the two-way, two-bottom, wheel-type plow. First, a tractor equipped with a two-way, mounted plow can be turned in practically the same radius as the tractor itself. Second, since it is desirable that all furrows be turned uphill, it was believed that more satisfactory work could be performed by operating a one-bottom 18-inch plow at some increase in speed

rather than a two-way, wheel-type plow with two 14-inch bottoms which would make a full load for the tractor. Later use in the field fully justified this selection.

With the two-way plow the operator is able to make the dead furrow fall at any given point. In plowing between terraces or on contour strips all furrows may be turned uphill, to counteract the forces of erosion³ and all turning can be done on unplowed land when plowing strips or lands of irregular widths. The two-way plow also has proved very effective in contour farming and strip cropping, as plowing operations can be made to conform to contour lines without inconvenience.

Figure 2 shows the same field as figure 1. On this chart, the contour lines of the land are shown as before, also the lines representing the direction of travel while using the two-way plow. In plowing the field by this plan the first operation is to lay out the guide furrows. In making guide furrows the plow is lowered only enough to make a mark. The areas are then plowed as numbered on the chart, and by plowing the areas as numbered the operator is able to turn a large percent of the furrows uphill. All turning may be done on unplowed land. When the field is completed, there are no dead furrows. A large portion of the work is completed without the tractor operating uphill and downhill.

A plowing plan need not be complicated and it can be made satisfactorily without the use of instruments. The main thing to remember is to plow the top of the hill first and work downhill so that all furrows are turned uphill and no dead furrow is left in the field. The average length of furrow as shown in figure 1 was 590 feet against 575 feet for figure 2. Since there is so little difference, there can be no objection to contour plowing from that standpoint.

It is interesting to note that prior to 1931 the gully in this 25-acre field was being crossed with some difficulty. Without control measures it soon would have been necessary to farm around this gully, thus dividing the field into two lands and reducing the average furrow length to about 398 feet. Variations from these figures will occur in different fields, depending on shapes and sizes, but this field appears to be typical of this farming area.

There is a further advantage to contour plowing, as with other contour tillage practices in this area. Side-hill slopes commonly have outcroppings of subsoil layers, heavier in texture than the surface layer. Generally speaking, such outcroppings occur along the

³ Musgrave, G. W., and R. A. Norton: *Soil and Water Conservation Investigations at the Soil Conservation Experiment Station, Missouri Valley Loess Region, Clarinda, Iowa*. U. S. D. A. Technical Bulletin 538, p. 93.

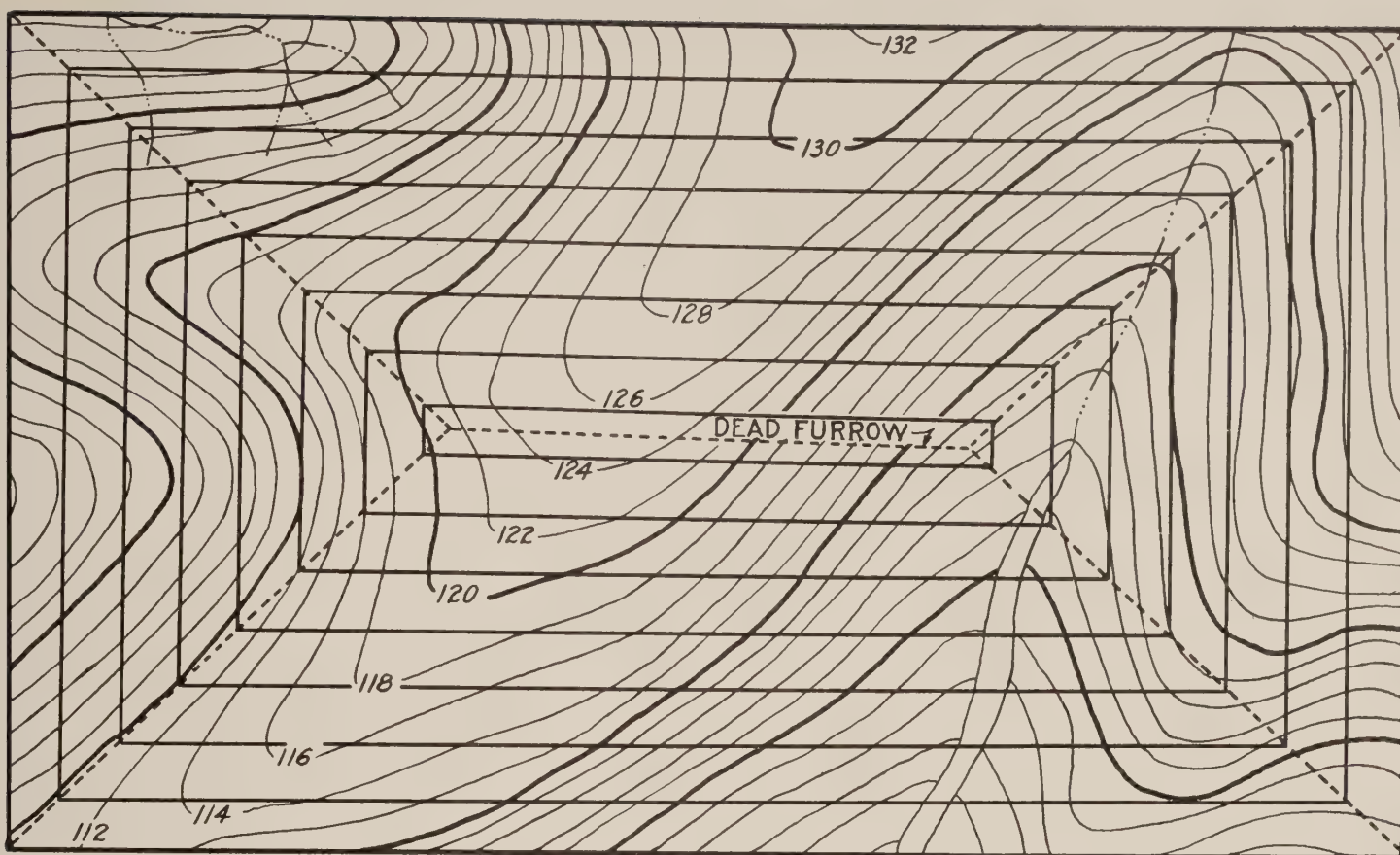


Fig. 1.—Map of 25-acre field that was being farmed as a unit prior to 1931. The contour lines of the land are shown, as well as lines representing the direction of travel of plow, using the method common to that area at the time.

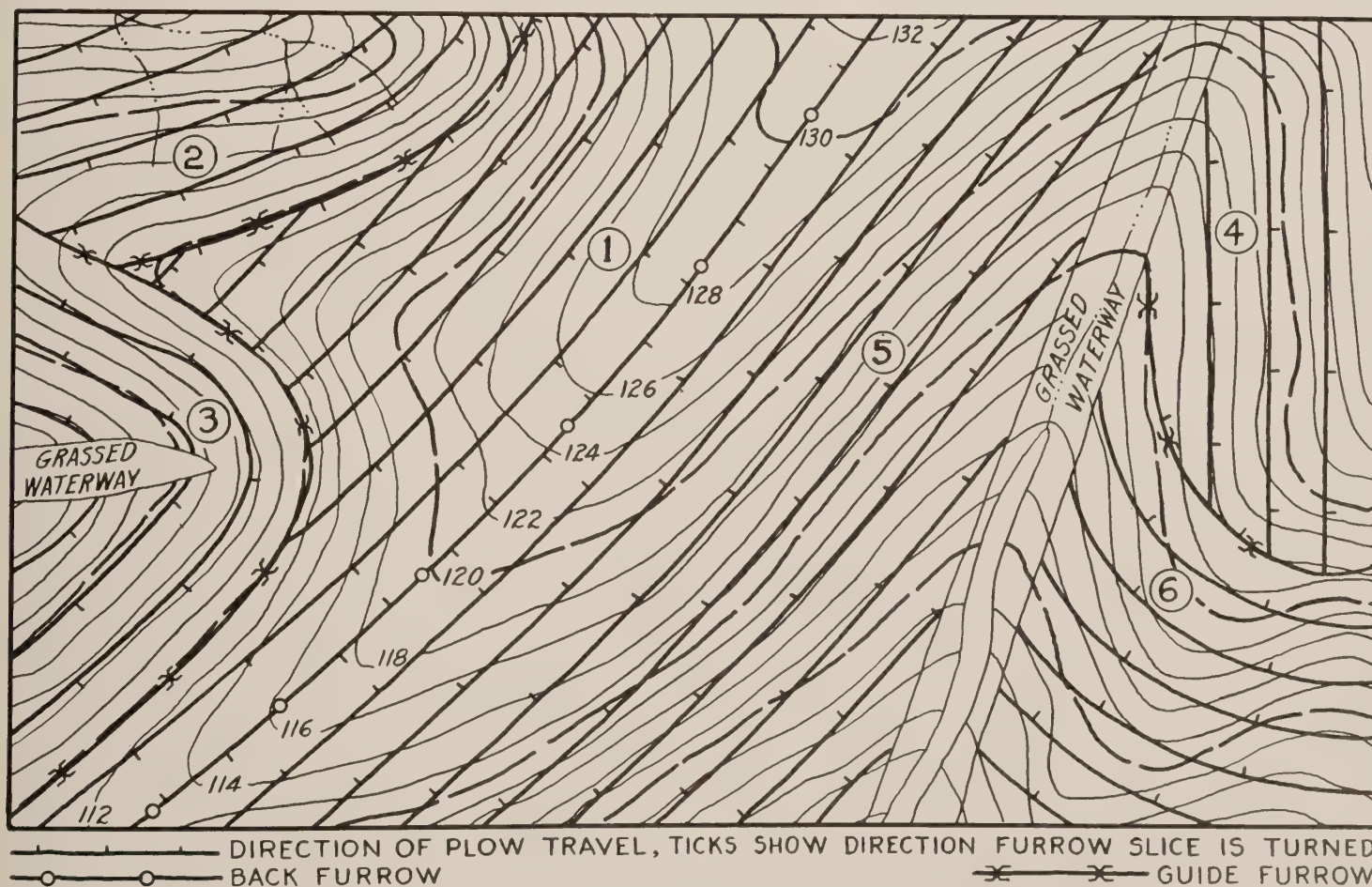


Fig. 2.—Map of same field shown in Fig. 1. On this map the contour lines of the land are shown as before. Also, the lines representing the direction of travel while using the two-way plow.

same contour line or at about the same level. In seasons of excessive rainfall, wet spots develop on these areas because of poor penetration of soil moisture and the farmer will find contour plowing convenient because he can work either above or below these areas while waiting for them to dry.

In plowing terraced areas with a two-way plow, it has been found satisfactory first to lay out a guide furrow parallel to the terrace ridge. This may be any convenient distance from the terrace crown that allows sufficient turning room for the tractor. The operator starts plowing on the crown of the next terrace above, or the field border, and works toward the guide furrow. Each time the tractor crosses the guide furrow the plow is raised. When all the area above the guide furrow is plowed there remains only an unplowed area of uniform width parallel to the terrace, and in plowing this strip the operator is able to place the dead furrow in the terrace channel. It will be noted that all furrows have been turned uphill, from the terrace channel to the terrace crown, and from the terrace channel uphill toward the next terrace or field border.

The two-way plow has been proved effective in maintaining terrace cross sections.⁴ In the study at the experimental farm, it was determined that two plowings by this method, in a 4-year rotation of corn, corn, oats, and clover, are sufficient to maintain the terrace cross section without additional grading.

Corn Planting and Cultivation

A three-row tractor planter and cultivator was selected in 1931 for use on the Soil Conservation experimental farm. The most common type in use on this area was two-row equipment, but it was believed that if terraces could be constructed so that satisfactory work could be performed with three-row equipment, no trouble would be experienced with the common two-row type.

It was found that satisfactory work could be performed with the three-row type of planter and cultivator. The three-row cultivator had the advantage of being very flexible. The outer cultivator gangs were carried between the tractor support and a wing wheel, while the center gang was carried on the tractor. This feature allowed the cultivator to operate over uneven ground in much the same manner as three single-row cultivators. One principal disadvantage to the three-row cultivator was that a wider than normal space was necessary between the rows on either side of the terrace crown. This was necessary because

in cultivating near the terrace crown, the wing wheel on the cultivator worked most satisfactorily when traveling exactly on the crown of the terrace. In order to meet this condition, it was necessary to place the corn rows so that the equivalent of one row was left out on the top of the terrace.

In the spring of 1939, a tractor-mounted, two-row, lister corn planter and cultivator was brought into use on the experimental farm. The planter is equipped with moldboard and loose ground lister attachments. The moldboard lister is used for planting in unplowed ground. The loose ground attachment consists of four 18-inch disks and planter shoes for planting in plowed ground. This machine was not equipped with a fertilizer distributor, but it was learned that by making certain alterations a second-hand distributor could be attached to this particular machine, as shown in photograph No. 4. This work was done in the shop at the experimental farm. The distributor was found satisfactory for applying fertilizer, particularly when used with the loose ground lister planter. The disks leave a small ridge in the center of the furrow and the fertilizer is spread on either side of this ridge. The planter shoe in turn splits this small ridge, placing the corn between the two bands of fertilizer.

For planting corn this type of planter, equipped with either the loose ground or moldboard attachment, fits in very well with conservation methods because rows may be drilled in lister furrows following contour lines. Musgrave and Norton state: "With checkrowed corn, little benefit will be gained by attempting to plant the corn in the general direction of the contour since, with this type of planting, the rows line up in either direction, and at least one cultivation is usually made at right angles to the direction of planting."

The moldboard lister has two additional advantages for planting corn as compared to the loose ground attachment. When the moldboard lister is used the ground is not commonly plowed before listing. For this reason this type is not used following a sod-forming crop; but where corn is to be planted following corn or a non-sod-forming crop, the listing operation requires only about 50 percent of the time that would be required for plowing. Furthermore, the planting is done in the same operation. Preparation of the seed-bed with disk or harrow is also eliminated. Listing with the moldboard lister has the further advantage that the crop residue of the previous season is left in the surface layer of soil thereby becoming more effective in water conservation.

When planting terraced areas on the experimental

⁴ Schoenleber, L. H.: *Terrace Dimension Changes and the Movement of Terrace Ridges*. Agri. Engr. 21, pp. 477-478, 1940.

farm, row number one is placed on the terrace crown of the next terrace above the area being planted—this provides the tractor with sufficient traction to avoid side slippage. This is important when planting in plowed ground with the loose ground lister attachment. The operator plants four rows parallel to the upper side of the area; then he starts parallel to the lower terrace ridge and plants uphill, making the point rows fall adjacent to the upper side of the terrace area. One reason for this placement of point rows is that the least possible difficulty is involved in turning with the cultivator at this area. Another reason is that it allows a greater percentage of the rows to be parallel with the terrace channel. Point rows ending in the terrace channel would tend to concentrate run-off thereby forming bars of soil in the channel. With the two-row equipment it is also possible to attain an even spacing of rows over a terrace ridge.

As to placement of rows in contour strips or contour fields, it has been found that, in general, rows should have slight drainage toward grassed waterways or field borders. Because of variations in land slope, width of strips, or locations of grassed waterways, it is difficult to devise a general rule that will work satisfactorily for all fields, but with these problems in mind, the operator can contrive means to fit his land and his particular farm plan.

In this corn growing area there is no one standard practice of cultivation and several different machines are in common use. A number of years ago a large percent of the corn was planted with the checkrow planter, but this has changed decidedly and at the present time fully 90 percent of the corn is drill-planted. A small percent is surface-planted with small furrow openers. The greater part is now planted in lister furrows made with either the loose ground or the moldboard lister.

In cultivating corn that has been planted with furrow openers, it is common practice to use the harrow or rotary hoe for the first cultivation, and the ordinary shovel cultivator for those following. The rotary hoe did very good work on this experimental farm on ordinary land, but serious difficulty was encountered on terraced land. The rotary hoe lacked the flexibility for satisfactory operation along a terrace ridge or in a terrace channel and much damage to the crop was caused in turning for point rows. The land roller or the harrow is used ordinarily for the first cultivation of corn that has been planted with the loose ground lister: the harrow is used where the soil is mellow and in good physical condition, while the

land roller is employed where the soil is cloddy. The remaining cultivations are done with the ordinary shovel cultivator.

Several different methods of cultivation are commonly used in this area where corn is planted with the moldboard lister. Many farmers use the listed-corn cultivator for the first two cultivations. Usually these cultivators, known locally as "snake killers" or "go devils," are constructed to cover two rows. Two large disks and two small shovels are employed for each row. For the first cultivation, the disks are turned so that the dirt is moved away from the row, while the two shovels run in the bottom of the furrow on either side of the row. Thus the lister ridge is left between the rows. The second cultivation is accomplished by reversing the disks to move the dirt toward the corn, while the shovels are widened to run in the lister ridge. After completion of this operation, the ground surface is practically leveled. The third cultivation is then done with an ordinary shovel cultivator.

The listed-corn cultivator has two distinct advantages over the ordinary shovel cultivator. First, the lister ridges are preserved until the second cultivation and thus the water impounding capacity of the lister ridges is maintained for a longer period. Second, the construction of this machine is such that it gives very little trouble even though large amounts of crop residues are present in the soil.

Another method of cultivating corn that has been planted with the moldboard lister is by use of the ordinary shovel cultivator for all cultivations. Usually the cultivator is equipped with common shields; or, the box shield of the listed-corn cultivator is adapted to the shovel cultivator. The four-shovel cultivator is more popular than the six-shovel type because the former operates more effectively through crop residues or "trash."

Most of the cultivation of corn on this experimental farm is done with the ordinary type of shovel cultivator. One exception is found where the corn is ridged at the time of the last cultivation. When rows are planted up and down hill most operators attempt to leave the ground surface as level as possible following cultivation, to avoid formation of small gullies between rows. On the other hand, when cultivating is done along contour lines it is advantageous to leave the ground uneven. Musgrave and Norton found that on an 8-percent slope an impounding capacity of two surface inches of water was possible without excessive ridging of corn rows. Thus, in contour farming, ridging of corn rows is a distinct advantage for soil and water conservation.

The first work with a grain binder over terraced land on the experimental farm proved rather difficult. In the beginning it was thought that most satisfactory work could be done by cutting each individual terrace area as a unit. Later another plan was tried—cutting along the sides of the field and driving across the ends of the terraces with the machine out of gear. Both plans involved some difficulty in operation of the machine and also required additional labor. When each terrace area was harvested as a unit, additional back cutting was necessary, causing some waste of grain and extra labor in carrying the bundles from the next area to be cut. Also in cutting the area adjacent to the terrace ridge the bundle carrier would drag so that it could not function properly. Several times, damage to the power-drive mechanism occurred in passing over a terrace when traveling from one area to another or in cutting around the entire field.

Prior to the beginning of the 1937 harvest season, an effort was made to find a more satisfactory method of cutting grain over terraced land. It was found that by modifying the design of the hook-up between the tractor and the power-binder the machine could be operated over terraces without damage to the power drive. The modifications consisted of rearrangement of the length of the segments of the power shaft in such a manner that a knuckle of the shaft would come directly over the connection of binder hitch and tractor draw bar, as may be seen in photograph No. 5.

After these changes had been made it was possible to cut around the entire terraced field, crossing the terraces at any angle. The only requirement is that it is better to approach the terraces in such a manner that the grain wheel on the outer end of the binder platform leads toward the terraces rather than following the remainder of the machine over them. If terraces are so placed on a field that, in cutting grain, the grain wheel does not approach the terraces in this manner, the sickle guards will occasionally catch the terrace crowns, but this situation can be remedied by cutting the field into two parts, cornerwise.

It is believed that a little ingenuity on the part of the operator is all that is necessary to ensure satisfactory operation of a power binder on practically any terraced field.

The practice of seeding cover crops in the fall following the first year of corn, in the 4-year rotation of corn, corn, oats, and clover, has been applied on the Soil Conservation Experimental Farm. It is believed that the ideal method of seeding is by the use of the one-horse grain drill which can be run through the

corn some time in August. In this area, however, corn plant growth usually is heavy, and storms sometimes cause considerable lodging so that drilling in the corn cannot be done. When these conditions exist and in seasons when the corn can be harvested early, cover crops can be seeded following the corn harvest with reasonable success. This seeding operation has been done with the ordinary grain drill equipped with a plank shield, shown in photograph No. 6.

The plank shield on the grain drill pushes the stalks forward so that they do not damage the drill mechanism, particularly the grain spouts. Likewise, since the cornstalks are still fastened to the ground, the drill passes over them without the bunching that might occur if the field was disked or harrowed preceding the seeding operation; and, incidentally, the labor of these operations is eliminated. Furthermore, if the seeding is done in the standing cornstalks the growth is left in better shape to hold winter snow than if the field were disked.

Recent developments in the reduction of grain crop acreages have favored spring seeding of sweetclover on cornstalk land without a nurse crop. Farmers may find that the drill equipped with a shield is a very effective tool for this seeding operation. Probably the seedbed would be in better condition for clover seeding than where the soil is stirred with a disk.

GOOD NEWS FOR SHEEPMEN

There is a new chemical—phenothiazine—that does away with much of the work, worry, and expense that used to go with producing lambs reasonably free of internal parasites. On badly infested pastures it has been necessary to dose each lamb individually, sometimes as frequently as every 2 or 3 weeks. The parasitologists of the Bureau of Animal Industry have found that winter cold kills most of the parasites on pastures, but that the ewes carry them through the winter and reinfest the pastures in the spring.

By mixing this newly discovered material—phenothiazine—in the ewes' feed in the winter, they may be made so free of their parasites that the lambs need be treated only once—maybe not at all.

Farmers should know about this new treatment for sheep parasites. Healthy sheep constitute an important factor in making profitable use of farm pastures; and greatly increased acreages of farm pastures are needed to protect and improve the soil and reduce the cost of livestock production. Sheep also are admirably adapted to provide farm families with the increased supply and variety of fresh meat that is sorely needed in our national defense program.—A. T. Semple.



The Bingham farm herd grazing on the irrigated pasture, against background of farm buildings and rough, brushy range lands.

THIS farm, 6 miles west of Morgan, Utah, in the fertile Weber River Valley, is owned and operated by Annie, Francis, and Amos Bingham. It now contains 81.6 acres of irrigated farm land equal to the best in the valley. Yields as high as 125 bushels of barley, 5 tons of alfalfa hay, 30 to 40 tons of cabbage, and 18 to 25 tons of sugar beets to the acre are not unusual in the valley from land such as occurs on this Utah ranch that goes by the name "Valimont Farm." In addition to the irrigated land the farm contains 769 acres of native range pasture and 16 acres of native meadowland.

The farm was purchased by the Binghams in 1922, at which time it was in a run-down condition with its crop-producing capacity low. The cultivated lands were low in fertility and their topography so uneven that they could not be cultivated and irrigated properly for production of maximum crop yields. The range lands also were in rather poor condition, and with further continuous over-use they deteriorated to a still greater extent. From 1922 to 1933 the Bingham used the range land for grazing by beef cattle.

By 1933 the Binghams had fully decided that a diversified agriculture that would make possible the utilization by livestock of all feed raised on the farm would be the most profitable organization for acreage such as the Valimont Farm. Thus it was that the farm lands were gradually leveled and put into better condition so that they could be used for the growing of feed crops such as barley and alfalfa.

At the time of reorganization the farm operations were pointed toward the gradual building up of a good milking strain of Shorthorns. A little at a time

THE VALIMONT FARM

By D. G. CRAIG ¹

this herd of Shorthorns is being improved and increased in numbers while the grade cattle are being eliminated. The Bingham soon learned, however, that the native range pasture, covered for the most part by browse species such as sagebrush and scrub oak, was unsatisfactory for this better type of livestock. The steep range lands were hard on these dual-purpose cattle, and much work was involved in their care and proper management while on the range. The brushy vegetation injured the udders of several of the better cows, and profitable milk and butterfat production proved impossible, even with a supplementary ration of hay and grain.

The Binghams became convinced that some other arrangement must be made for pasture. They were reluctant to convert any of their most fertile farm land to pasture, but they decided to try a small acreage as an experiment. Thus in 1938, with the assistance of the Soil Conservation Service, 4 acres (field 5a on the accompanying land-use map) of the best soil on the farm were planted to a grass-legume mixture consisting of the following species:

	Pounds
Smooth brome (<i>Bromus inermis</i>)	4
Kentucky bluegrass (<i>Poa pratensis</i>)	4
Orchard grass (<i>Dactylis glomerata</i>)	3
Meadow fescue (<i>Festuca elatior</i>)	4
Perennial ryegrass (<i>Lolium perenne</i>)	3
White Dutch clover (<i>Trifolium repens</i>)	3
Alsike clover (<i>Trifolium hybridum</i>)	2

¹ Assistant chief, regional agronomy division, Southwest Region, Soil Conservation Service, Albuquerque, N. Mex.

This mixture was seeded with a grain drill at the rate of 23 pounds to the acre.

The pasture was grazed by the farm herd in 1939. The small 4-acre tract adequately pastured 15 mature, high-producing milk cows during the growing season. Grazing was commenced May 1 and ended September 30. In 1940, 20 head of dairy cows obtained 80 cow months of grazing from the small irrigated pasture; the grazing was in the late spring, summer, and fall months. The milk cows were fed, in addition to the pasture, a small amount of grain and were offered alfalfa. As a general rule they refused the alfalfa, as the forage from the irrigated pasture was sufficient to satisfy their forage requirements. This is in direct contrast to the situation that existed before the irrigated pasture was available when the cattle, while utilizing the native range, consumed several tons of supplementary feed in the form of alfalfa hay, as well as a considerable amount of grain.

The 4-acre pasture is divided into two equal parts which are grazed alternately. The general plan is to irrigate each tract at intervals of 2 weeks. One tract is irrigated and given a rest, while the other part is being grazed by the entire farm herd. This procedure is repeated at regular intervals throughout the grazing season. Such a system of management prevents injury to the pasture from trampling while the soil is wet and unfirm following irrigation. For the same reason the cattle are removed from the pasture for a short period after heavy rains. This is an important part of the management of irrigated pastures.

The system of farm management which has been instituted by the Bingham has resulted in the several benefits outlined below:

1. Crop yields have been decidedly increased as a result of conditioning of the land through leveling, the institution of proper cultural practices, and use of large quantities of barnyard manure to improve fertility of the soil.

2. Cash crops are no longer grown. Hay, grain, and pasture crops comprise the rotation. None of the crops are sold—they are all fed to livestock on the farm. Each year several head of steers are fattened for market. During the winter of 1940–41, 80 head were fed. This feeding program requires large quantities of purchased feed over and above that raised on the farm. Consequently, many additional tons of barnyard manure are produced to be applied to the cultivated lands to maintain and improve fertility.

3. Addition of irrigated pasture has made it possible to reduce the grazing pressure on the already overgrazed range lands to a point below their actual carrying capacity. As a result, a decided improve-

ment of these lands is noticeable after only 1 year of grazing below actual carrying capacity.

4. The labor required to handle the farm herd has been greatly reduced. Instead of searching over 769 acres of rough, brushy country for the farm herd each day it is only necessary to walk a short distance to the irrigated pasture where the animals are easily obtainable.

5. The Bingham herd has come to be one of the highest producing herds in the Weber River Valley according to the Herd Improvement Association. The production in 1940 averaged 345 pounds of butterfat per cow for the entire herd of 17 producing cows. Accordingly, the association has also found that the Bingham herd is one of the most economical from the standpoint of production in the entire valley.

6. No udder injuries have occurred since the irrigated pasture has been substituted for the brushy range.

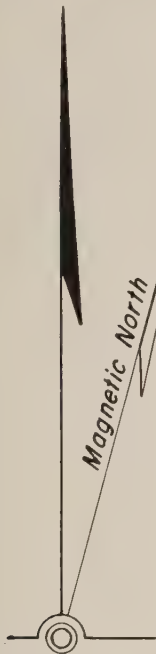
7. During the growing season, a saving is made in feed. The use of the pasture makes unnecessary the feeding of supplementary forage in the form of alfalfa hay to the milking cows.

The development of good pastures is fast becoming a part of the farming practice on the dairy farms of Morgan County. Fifteen new pastures were started on farms that in past years had no improved pastures. Records kept by some of the good dairymen indicate that these better pastures have had a carrying capacity of four cows per acre where small amounts of grain are fed, and probably a little hay, during milking time. With no supplemental feeding, some of these pastures have furnished ample feed for three cows per acre. Rotation pasture is the practice in most cases. These records indicate a return of \$100 to \$120 per acre in butterfat produced. No other crop under present conditions is giving better results. The difference in labor costs of harvesting pastures and other crops has not been considered.

Farmers in the Weber River Valley have been reluctant to plant pasture mixtures on their better land, thinking that the income from pasture could not equal that from the truck crops commonly grown. The Bingham shared that feeling at first, but after 2 years' experience they maintain that irrigated pastures properly handled will produce a net return fully equal to that from any crop adapted to this area.

As a result of their experience the Bingham have instituted a more vigorous herd improvement program. They recently purchased three cows of nationally recognized milking Shorthorn lineage. These three cows, Elmdale Lucy, Northview Lady Waterloo, and Northview Alma, will form the basis of the future Valimont Farm herd.

N



LEGEND

LAND USE CAPABILITY CLASSES

FARMING LAND



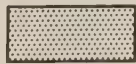
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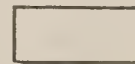
IV



VI



VIIa



VIIb

RANGE LAND

Land-use capability map, Valimont farm, Morgan, Utah.

BUILDING A SOIL CONSERVATION PROGRAM THROUGH GROUP ACTIVITIES

By JOHN W. FORD, Jr.

"LIFE is so short—and there is so much to be done!" An old man once said that to me and the thought has grown into a philosophy of life and of work.

Because "life is so short," we cannot spare time for unsound or unworthy objectives. This is certainly true with the county agent who has so many opportunities to "chase rabbits." We want to know that any project which is given precious time is one which, carried to successful conclusion, will benefit mankind.

When a new agricultural plan comes along, farmers and county agents like to try to pick it apart, to find the bugs in it, and decide how we think it will work.

There is a story about a farmer who had a couple of boys who were also pretty curious about new contraptions. Whenever this farmer came back from town with some new piece of machinery like a cotton planter, or a fertilizer drill, or a clock, the boys right away took the thing all apart to see what made it work.

One day the farmer got back from town in his wagon, and the boys rushed out to see what he had brought with him this time. The old fellow got out of the wagon, dropped a great big anvil on the ground, and growled, "There, gol darn ye, let's see you take *that* apart!"

Well, when this soil conservation district program came along, we found it was so sound we couldn't pick it apart. They had given us an *anvil*.

Each year before going to the Extension Program Planning Conference we of Autauga County get with our county planning committee and reexamine situations and objectives. "In a multitude of council is wisdom"—and a lot of good cooperation later on! This committee helps us keep our feet on the ground and brings us back each year to soil conservation as being fundamental. So we build our extension program again around that objective, offering our help again to the soil conservation district supervisors, requesting extension specialist help accordingly, and determining again to use the AAA program and our Extension organization and Farm Bureau as working tools for the purpose of conserving and building up

the land and the forest to the end of better living for our people. So if life is short, at least we are spending it wisely.

Now, because "there is so much to be done," we have to employ group action to get a worthwhile volume of accomplishment.

Our officers of community organizations were constituted committees on priority in the first year of district work in the county. This gave us some prime cooperators, geographical spread, and right locations of farms to serve as demonstrations. That objective reached in the first winter of operation, we came back and developed reasonably solid blocks of farms for district treatment and, by employing the group school method, increased both volume and effectiveness of technical help.

By last March we had a lot of interesting things showing up on cooperating farms and going to waste from the standpoint of their educational value for other people. Too, we realized that in order to get maximum spread of practice we would have to take people to see the things that are done on these farms, so we started holding tours. From the first of March until September first we conducted a "Friday farm tour" each week. These tours were attended by an average of thirty-four farmers and on several occasions by classes in vocational agriculture. Although scheduled and arranged by the technician and county agent, the "Friday farm tour" was the host farmer's own party and he did most of the talking.

We can trace a vast amount of "spread of practices" to the "Friday farm tour" program—but we discontinued it in September.

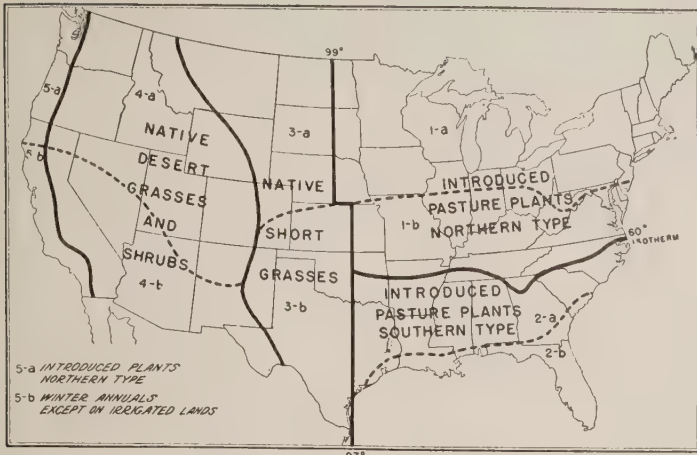
A month or so ago the "Friday demonstration," successor to the "tour," was born. As long as farmer interest justifies, we will be helping some cooperator each Friday afternoon set kudzu or plant pines or build slip-scraper terraces, we friends of his from miles around.

"Life is short," so we are working on fundamentals. "There is so much to be done," so we are getting many and many an extra hillside wrapped up by working with people in groups.

Glennon Loyd, in an article to appear in the November issue, writes about "A Pasture That Does Not Take 'Annual Leave.'" It is in a farm near Spring Valley, Minn.

Editor's note.—The remarks quoted are abstracted from a paper presented at the meeting of the Soil Conservation Section, Association of Southern Agricultural Workers, 42nd Annual Convention, February 6, 1941, at Atlanta, Ga. The author is County Agricultural Agent, Prattville, Ala.

SUGGESTIONS FOR PASTURE MIXTURES TO MEET VARYING CONDITIONS



II

Q.—I want to establish a soil-conserving, profitable pasture in the east-central part of the United States. What type of mixture shall I use?

EAST-CENTRAL STATES (section 1-b of the map)

Mixture for good, well-drained soils:		Pounds per acre
Kentucky bluegrass	5 or 6	
Orchard grass	4 or 5	
Timothy	2 or 3	
Redtop	2	
Lespedeza	6 or 7	
White clover	1 or 2	
Total	20 or 25	

Mixture for poor, well-drained soils:		Pounds per acre
Orchard grass	5 or 6	
Tall oatgrass	4 or 5	
Redtop	4 or 5	
Lespedeza	7 or 9	

Total..... 20 or 25

Mixture for wet, poorly drained soils:		Pounds per acre
Timothy	5 or 6	
Redtop	8 or 10	
Alsike clover	3 or 4	

Total..... 16 or 20

Mixture for wet, poorly drained soils where meadow foxtail is preferred:

Meadow foxtail	4 or 5
Redtop	8 or 10
Alsike clover	4 or 5

Total..... 16 or 20

In the northern part of this section the Korean lespezo should be used. In the southern part, Common, Kobe, or Tennessee 76 are best. Good results are obtained from a mixture of Common and Korean in Tennessee and North Carolina.

AGRICULTURE'S CLEARINGHOUSE FOR DEFENSE ACTIVITIES

(Continued from p. 99)

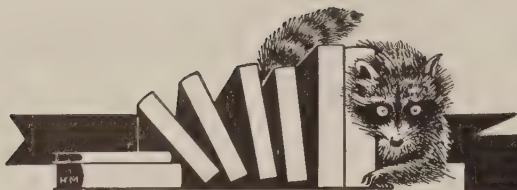
One was the granting of an emergency rating on sheet steel to be used in the construction of grain bins needed by farmers facing a serious shortage of storage space. Another was the granting of a high preference rating to deliveries of materials needed by plants constructing or repairing canning equipment and machinery. This was done in order to prevent possible loss of a portion of the 1941 fruit and vegetable crop.

It is reasonable to believe that in the future—when we can present a real case for the need—similar attention will be given other agricultural necessities. On the other hand, there are many things for which we may have to devise substitutes, or even get along without them altogether. It all depends on the needs of our armament program and its importance as weighted against the needs of agriculture and the other industries classified as "essential."

Further evidence of the importance of the farmer

in the defense picture may be found in the fact that agriculture has full representation on the commodity groups established in the Office for Emergency Management. This means that in the production, allocation and use of strategic materials, agriculture has a full voice in the proceedings as they apply to materials that affect agriculture.

All of these things go hand-in-hand with agriculture's responsibilities in national defense. In order to have a united and coordinated administrative channel for defense activities, Secretary Wickard has established a United States Department of Agriculture Defense Board in every State and every county. These boards are made up of representatives from each of the Department agencies whose services are needed by the Secretary to administer actions necessary to carry out departmental responsibilities in national defense.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

FACTORS OF SOIL FORMATION. By Hans Jenny. New York and London. August 1941.

Here is a somewhat revolutionary book that goes deeply into the study of soil properties and correlation of soil-forming factors with those properties. The author, who is Professor of Soil Chemistry and Morphology, University of California, is of the opinion that any true advancement in the fundamental knowledge of soils will involve an organization of the data by laws and theories, in addition to classifications. He hopes that such a mode of approach will assist in the understanding of soil differentiations and will help to explain the geographical distribution of soil types. The soil-forming factors treated in great detail are topography, time, parent material, climate, and organisms.

The formulary method used by Professor Jenny to show functional interrelationships of properties in the soil system serves to put this volume definitely in the class of an advanced text on theoretical soil science. Symbols are used throughout to indicate soil forming factors and soil properties as related to differentiations in the state of the soil system. The plan of the book, and the "new concept of soil-forming factors" are explained quite thoroughly in the opening chapters; likewise, no doubt for soil surveyors in particular, the terms and symbols adopted to represent the "independent variables" necessary in considering the soil as a dynamic system are explained at the beginning and throughout this treatise. Soil surveyors are urged by the author to place more stress on soils data having to do with these "variables"—climate, organisms topography, parent material, time—and, what is more, they are instructed in the use of such data in making soils histories, classifications and analyses.

The main part of the book is devoted to chapters treating separately the five soil-forming factors and their relationships in soil knowledge. Apparently Professor Jenny's idea is that soils geographers and soils "functionalists" should correlate knowledge and data in the interests of a far broader scope of knowledge regarding the earth's soil system and a more accurate assemblage of practical information. Other sciences too are discussed as having tremendous potential bearing upon soils research—plant ecology, climatology, geomorphology in its erosion and denudation aspects, the various geological sciences, even the social sciences.

In the chapter on climate as a soil-forming factor, one finds many thought-provoking theories, expressed occasionally in the form of queries, or as criticisms of more or less established methods of collecting and assembling data. This long chapter is divided into four sections treating in detail the important soil-forming variables, moisture and temperature, the interplay of the two in influencing soil formation, and the distribution and groupings of soils according to these two climatic subfactors. To a large extent this part of the book consists of an assemblage of principles, laws and theories of the great climatologist-pedologists of the world—Thorntwaite's moisture classification, Crowther's percolation factor, Hilgard's studies of soils from the arid and humid regions of the United States; Van't Hoff's temperature rule and Ramann's weathering factor, Latimer's data on chemical composition of podsol soil, Bennett and Allison on the laterite profile; and, of course, Marbut's Atlas, quoted throughout the volume.

Russia and the United States are the two great territories featuring most extensively throughout Professor Jenny's scholarly treatise. Russian pedologists are allotted considerable space for their careful and extensive soil classification work; but the final chapter, dealing with organisms as a soil-forming factor, becomes somehow rather more an American contribution both in idea and in areas of experimental achievements. In this chapter the author greatly clarifies the role of vegetation in soil formation by assigning to plants a dual role involving both the dependent and the independent variable. The latter role brings out considerable recently acquired information on plant succession and soil formation, transition zone profiles, chemical composition of plants as related to profile features under forest and under cultivation, the effects of cropping, burning, irrigation, etc., upon soil formation, and soil productivity and fertility trends under average farming conditions. Professor Jenny does not go deeply into the subject of soil micro-organisms for the reason that his book is "a treatise on soil-forming factors and does not undertake to study soil-forming processes."

The extensive bibliographies included at the ends of chapters serve to round out the logical frame of this critical discussion of a most important subject.

SOILS AND SOIL MANAGEMENT. By A. F. Gustafson. New York and London. 1941.

Professor Gustafson follows up his book "Conservation of the Soil" with this text on economical use of the soil for production of crops that can be turned into adequate income. Should this new volume become widely used as a textbook in agricultural colleges it will no doubt find its way into many a farm home library—students will put it aside as a book to be kept throughout years of actual farming experience. Some of the chapters contain information adaptable to actual field farming; while the book as a whole will serve very well to help the farmer to an understanding of the land he tills.

The author gives special attention to the following: soil organisms and the organic matter of mineral soils; the various means of controlling water in the soil; tillage, with special reference to implements; erosion and its control; soil acidity and liming; management of alkali soils; maintenance of nitrogen in the soil; the production, conservation and utilization of farm manures; green-manure crops; fertilizers and their use; the rotation of crops; long-term maintenance of mineral soils' productivity; reclamation and fertilization of peat and muck soils.

Leading article in the November issue is by Harry L. Carr and G. E. Ryerson, "Tooling Up for Soil Conservation." It is observed by the authors that "As progress in soil conservation techniques has brought changes in agricultural practices, farm equipment men have developed new machines and altered old ones to meet the new demands."

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



Field offices should submit requests on Form SCS-37, in accordance with the instructions on the reverse side of the form. Others should address the office of issue.

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¹ From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



FISHING is one of the most ancient of all human occupations, but in silt-charged waters the most patient fisherman will rarely get even a nibble. Sunlight is essential for the production of fish food, but light cannot penetrate far into muddy water. Hence, a farm pond is likely to be really productive of fish only on a farm properly organized and operated to conserve soil.

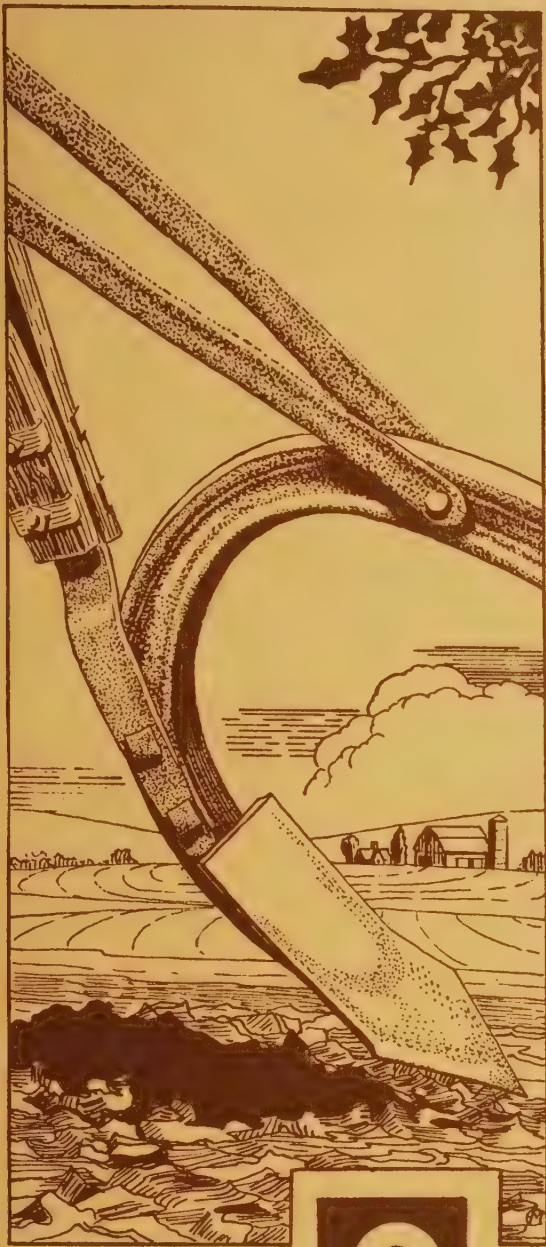
In a pond everything alive is good eating to some organism or another, and the fish are fine food for man himself. In a pond—myriad, floating, microscopic millions of minute animals, fed upon and devoured in turn by larger ones. All upon the phytoplankton, which, with sunlight to manufacture food. Some of these minute but important plants are figured on the front cover, drawn 200 times their natural size.



Upon the phytoplankton—live the swarming by small fish that are dependent. Pond life depends ultimately like other green plants, requires sunlight. Some of these minute but important plants are figured on the front cover, drawn 200 times their natural size.

As with livestock, fish can be produced better by fertilizing the plants upon which they feed. This method has long been used in Europe where more meat per acre is obtained by fish culture than by livestock farming. Potentially enormous quantities of high-quality food can be produced in the thousands of ponds on American farms. —W. R. VAN DERSAL





NOVEMBER 1941

BUILDING UP
PASTURES IN
THE SOUTH

SOIL CONSERVATION
OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

New methods in agriculture require new tools. With speed and thoroughness which match those of defense-stimulated industry, the American farm plant is being retooled for soil and water conservation. The progress in mechanical techniques is charted by Harry L. Carr and G. E. Ryerson, beginning on page 113.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

	Page
Tooling Up for Soil Conservation: By Harry L. Carr and G. E. Ryerson.....	113
Pasture Development in the South: By R. H. Lush.....	117
Chris Olsen, Montana Farmer: By William C. Pryor.....	121
Conservation Practices Receive Approval of Bankers.....	124
Can Farmers Afford To Grow Their Power: By A. T. Semple.....	127
Book Reviews and Abstracts: By Phoebe O'Neill Faris.....	128
For Reference: Compiled by Etta G. Rogers.....	Opposite 128

Front and Back Covers
"Evolution of the Plow"
By C. E. Margraff

WELLINGTON BRINK
EDITOR

SOIL CONSERVATION is issued monthly by SOIL CONSERVATION SERVICE of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business, with the approval of the Director of the Budget. SOIL CONSERVATION seeks to supply to workers of the Department of Agriculture engaged in soil conservation activities, information of special help to them in the performance of their duties; Copies may also be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., 10 cents a copy, or by subscription at the rate of \$1.00 per year, domestic. \$1.50 per year, foreign. Postage stamps will not be accepted in payment.



SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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NOV. • 1941



Moldboard remodeled by SCS for contour furrowing, 22-inch blade. There is a power-lift damming attachment at the rear of the plow.

Tooling Up for Soil Conservation

By HARRY L. CARR and G. E. RYERSON¹

DURING the last year or two, American industry has been feverishly engaged in "tooling up" for the production of military material. Machines must be designed, built, and put in place for making the parts that go into guns, planes, tanks, and all the other articles of war. It is vital business, and the success of our national defense depends on the speed and efficiency with which the job is done.

With less fanfare and publicity, but with matching speed and thoroughness, the American farm plant is also being tooled up—tooled up for soil and water conservation. The process has been going on for several years; lately it has speeded up, paralleling in intensity the mounting enthusiasm among farmers for farmland improvement.

New methods in agriculture require new tools, because the farmer depends upon his implements and machinery no less than does the factory. As progress in soil conservation techniques has brought changes

in agricultural practices, farm equipment men have developed new machines and altered old ones to meet the new demands. Experiment station experts and soil conservation technicians helped with ideas and inventions. And, as always, the American farmer made his own contributions to farm technology.

Most interesting, perhaps, of all the machinery and equipment recently developed in response to the demands of conservation farming are those for new methods of tillage, particularly for stubble mulch.

The stubble mulch system of cultivation has been called "the most promising conservation development in recent years." The term is applied to any process of protecting cultivated or bare land by the use of a complete or partial surface covering of crop residue or stubble. Most of the implements for this purpose provide for subsurface tillage without disturbing the surface litter. They range from a straight blade, drawn through the ground a few inches under the surface, to modifications of the duck-foot shovel, with the wings lengthened and mounted so that the cuts overlap.

¹ The authors are associate information specialist, division of information, and head, equipment section, division of engineering, Soil Conservation Service, Washington, D. C.



Orchard type disk harrow being used to disk kudzu vines in early spring, stimulating growth.



Tree planting machine developed and built by the Service to be used in establishing windbreaks.

The old rod weeder has come out in a new guise, with a modified duckfoot shovel that rides in front of the rod, permitting use of the machine in hard ground. Another machine, a sort of hybrid of the field cultivator and chisel equipped with bull-tongue shovels, loosens the soil without covering the surface litter.

All these implements are being built strong enough and with sufficient clearance to work in unplowed ground without clogging.

Other subsurface tillage machines of the shovel type are being built for row crop cultivation. Disks



Close-up of terracing attachment on tractor.

are being used to prevent covering of the crop. The conventional moldboard plow has undergone major operations to enable it to perform its usual operations without unduly covering the surface litter. The disk harrow has also been revamped—the curvature of the disks is made shallower so that it does not throw soil over the surface residue.

Another machine has been developed that gathers up trash in front of the tractor and blows it over the ground after the plow has passed, thus permitting a conventional plowing job while maintaining the cover of plant litter. A new mulcher, fed through a hopper, distributes any type of mulch in uniform layers over crop rows. In a few areas a rotary subsoiler is being used, which breaks up the soil without materially altering the surface layer.

Other tillage implements designed for conservation of soil and water are the various damming and basin-forming machines. Damming attachments are being manufactured by most of the implement companies for use with their conventional listers, and basin-forming attachments are sold for use with practically



Home-made sodding equipment.

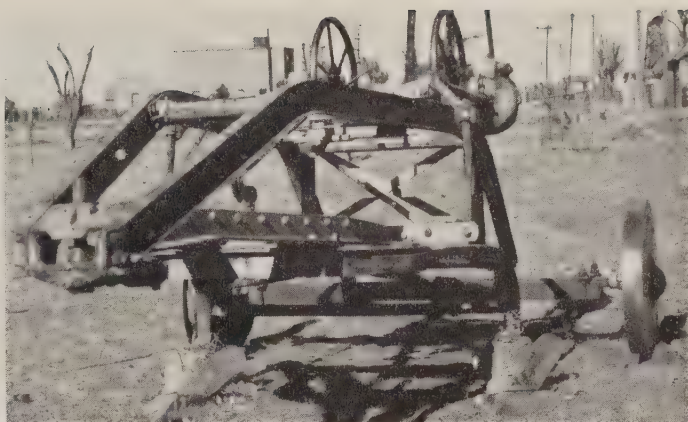
all types of farm tillage machinery. There is even a basin-forming chisel. Soil conservation men have also developed a machine to form dams in furrows left by corn cultivators.

Implements for surface tillage have not escaped the attention of conservation-minded inventors. Subsoiling attachments for conventional plows are gaining in popularity. A rotary hoe attachment on a row crop cultivator has proved helpful, not only for weed control, but in eliminating the furrows left by the cultivator. Operated backwards, it will work in trashy cover without picking up litter and clogging. A special machine has been developed for cultivating kudzu.

Use of the two-way plow is spreading rapidly. Several manufacturers are making mounted types, while nearly all make the trail type.

To meet the increasing needs for machinery for planting and seeding, especially in the field of cover crops, American inventiveness has furnished a number of new devices. There are cyclone seeders for attaching to corn cultivators, to permit the seeding of cover crops at the time of the last cultivation. Similar attachments for cultipackers aid in the establishment of crimson clover. Other machines simplify and speed up the establishment of sod. Various stationary shakers and attachments for moldboard plows reduce the cost of harvesting Bermuda sod for transplanting. Complementing these machines are devices consisting of furrow openers, hoppers for the Bermuda roots, and chutes for dropping the sprigs in the furrow. Covering devices follow, sometimes with press wheels.

The opener type double disk coultter, further improved, has come into wider use for native and tame grasses as well as small grains and in all types of mulch.



Two-row contour furrowing machine.

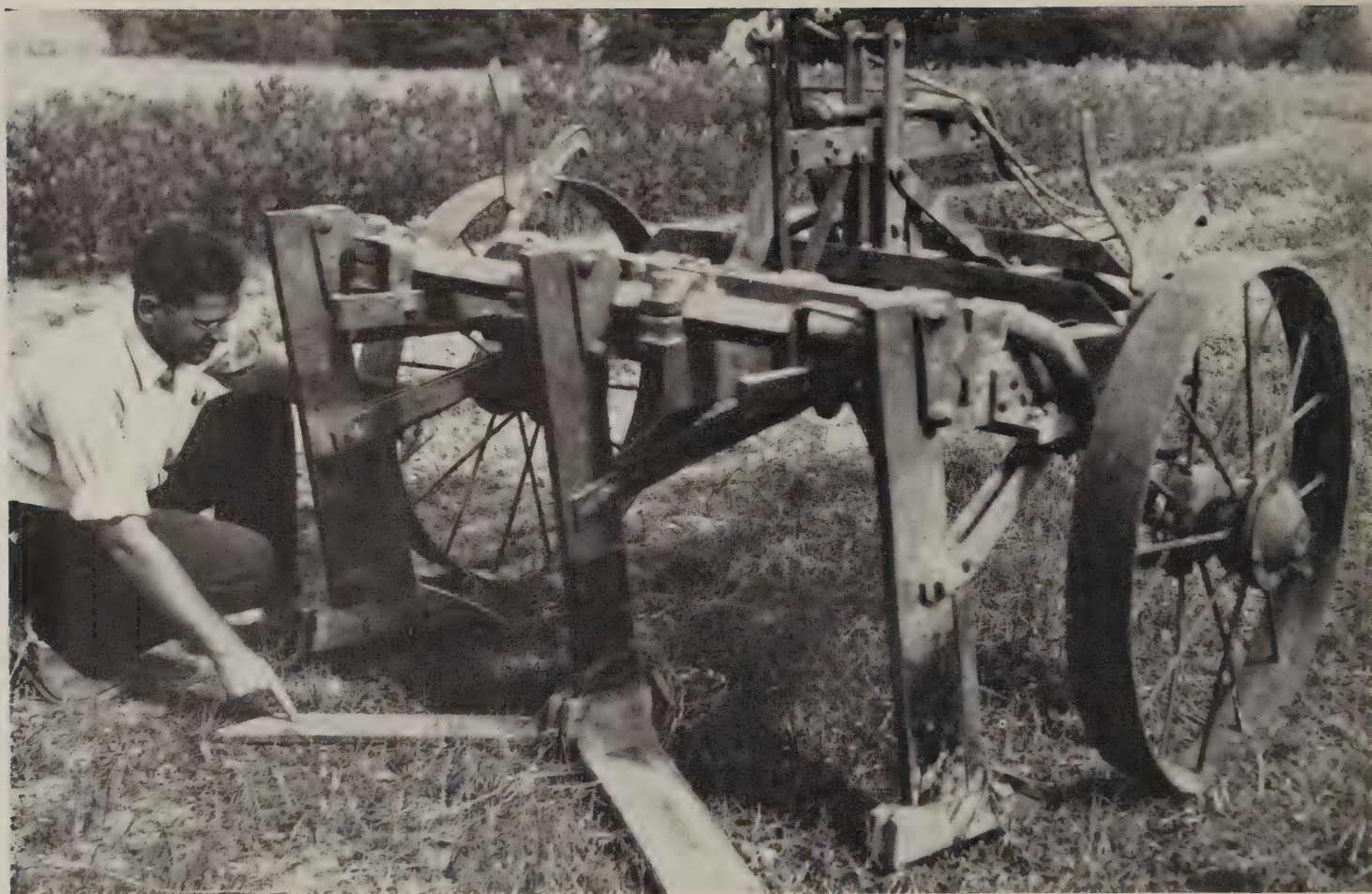


Lespedeza combine attachment. Note straw residue.

Modifications in grain drills have improved their covering ability and minimized clogging troubles while operating in trashy cover. A grass seeder has been adapted for use in conjunction with the blocking lister. The field scale planting of kudzu has been greatly facilitated by the development of a special kudzu planter, and large-scale tree planting is made easier and cheaper by a newly perfected machine.

Among farmers who object to drilled corn in contour operations, hill-dropping attachments are increasing in general use. Potato planters have been modified to permit effective operation on the contour. This modification permits more accurate control of depth and the relationship between seed and fertilizer placements.

The spread of conservation farming has also had its effect on harvesting equipment. The development of small combines has removed much of the difficulty of harvesting small, irregularly shaped fields. A pusher-type mower has been developed that will work in narrow spaces in orchards inaccessible with conventional offset mowers. Potato diggers have been altered so that the bed can be kept level while the machine is



Kudzu digger adapted from Killefer tree digger.

traveling on the contour, thus preventing crowding and bruising of the potatoes.

Combines have been equipped with straw spreaders to protect the soil and add organic matter.

For harvesting soil-building and soil-conserving crops there are devices for lifting kudzu crowns, cutter bar attachments to permit mowing of kudzu, mower and combine attachments for collecting lespedeza seed, and other equipment for harvesting the seeds of native grasses—formerly very expensive and difficult to collect.

The gradual advance of terracing from the South to all other sections of the country has brought with it new, simpler, and better terracing machines. Some are heavy and large, for the professional terracer; others are designed for use by farmers. Among contractors and cooperatives, the road maintainer or auto patrol has become popular for terrace building because of its one-man power-operated controls and self-propulsion on the highway.

For farmer use there is a combination plow-terracer consisting of a conventional plow bottom delivering its furrow slice to a standard terracer moldboard. Small farm tractors have been equipped with power-controlled disks which show great promise in terrace construction. The "whirlwind" terracer is now available

in a reversible model. The small elevating grader type terracer has been made better and cheaper.

Significant advances have been made in adapting ordinary equipment to terrace building. Good terraces are being constructed with slip scrapers, rotary scrapers and fresnos at very slight cost. The standard orchard disk harrow has been used successfully to build up terraces in orchards by repeated disking. Other commercially manufactured terracers have been modified and improved to keep pace with rapidly increasing knowledge of this important soil-conserving measure.

Earth-moving equipment has been made available to farmers by means of small wheel-type scrapers for use with the ordinary farm tractor. Such machines enable farmers and ranchers to construct ponds, water storage dugouts, diversion ditches, and other earthworks. Crescent scoops used with double-drum tractor-mounted winches are also employed in farm pond building and similar work. Truck excavators have proved valuable in cleaning, deepening, and widening drainage ditches too small for dragline operation.

Contour furrowing machines of many types have been developed, most of them modifications of con-

(Continued on p. 126)

Pasture Development in the South

By R. H. LUSH ¹

RIGHT now we are in the midst of a program for bettering human nutrition and increasing food for defense. Research has shown that the quality of milk and eggs, and more recently of beef also, depends on the feed the animals consume. Better nutrition should start at the grass roots, and it is going to take the combined efforts of the Soil Conservation Service, the Agricultural Extension Service, the Agricultural Adjustment Administration, and many other agricultural agencies to see that the grass roots are properly fed.

In 1939, nearly 5,800,000 farmers in the United States participated in conservation practices. These included application to the soil of nearly 5,800,000 tons of liming materials and about 636,000 tons of superphosphate, 16 percent equivalent. Probably not more than 390,000 tons of this superphosphate was placed on potential pastures or hayland. If this tonnage were applied to the pasture land, it would replace only one-tenth of the phosphorus removed by grazing. How much fertilizer has been purchased privately, outside Government grants-of-aid, for use on pastures to increase feed consumption, is difficult to determine. According to a consumer survey for 1938, about 2.8 percent of the plowable pasture of 23 States received an average of 230 pounds per acre of fertilizer. This is a good beginning but not nearly enough. It puts the pastures, as far as required plantfood is concerned, in the same position as an individual needing a minimum of 2,000 calories a day and receiving only 300 calories with no attention to protein, vitamin, or mineral requirements.

The depletion of fertility in pastures is constantly under way. Each pound of meat, each quart of milk, removes plantfood from the soil. An average cow will eat the equivalent of 2 tons of dry pasture grass during the grazing season, if available. That much feed removes from the soil 115 pounds of nitrogen, 26 pounds of phosphoric acid, 93 pounds of potash, and 37 pounds of calcium oxide. Even with conservation of the manure, one-half of the nitrogen and phosphorus and 30 percent of the potash may be lost to the pasture soil. With other classes of farm animals, the plantfood losses are somewhat less. Supplemental grain feeding tends to reduce the net losses in fertility, but in a program of pasture and roughage feeding we are not adding much fertility from that source.



Beef cattle of high quality are increasing along with improved pastures in the South.

In the South we are confronted with the problem of putting some of the poorer crop land, particularly that recently in cotton, into pasture. But there must be enough fertility added to this soil to produce a root system that will hold and make use of manure later dropped on the pasture, else much of the labor and seed of pasture improvement will be lost.

Economical production of livestock in the South depends primarily on a liberal supply of home-grown feeds, chiefly pasture or other forms of forage. The supply of pasture is becoming more adequate, as shown by the Census figures. Excluding Texas and Oklahoma, the total acreage of plowable pasture in the other 12 Southern States has increased approximately 8,000,000 acres, or 42 percent, in the last decade. The increase in woodland pasture has been about 5,000,000 acres. Hence the total amount of pasture available for livestock grazing is now about 114,000,000 acres, or 13 percent, more than it was 10 years ago.

During this same period in these States there has been little change in the total number of horses or sheep, an 11-percent decrease in the number of mules, about 12-percent increase in cows milked, 26-percent increase in total cattle, and an increase of 44 percent in number of hogs. The total number of animal units in these 12 States is now nearly 12,000,000, or 13 percent higher than it was 10 years ago. This indicates that slightly less than 10 acres of pasture is available for each animal unit. Considering only the most valuable plowable pasture acreage, there are 2.3 acres available per animal unit. Much of the rest is of poor quality, or in woodland, and should continue to raise trees. There are, of course, other sources of forage supply such as field crops for grazing, forest land, and

¹ Pasture Specialist, National Fertilizer Association, Washington, D. C.



Mares and colts on a fertilized pasture in Maryland.

waste land, but dependence upon this and two acres of ordinary plowable pasture is hardly adequate, according to accepted standards.

To depend entirely upon grazing of these pasture acres cannot give maximum production because of the variation in supply. Results in Louisiana, where pastures were clipped at monthly intervals for 8 years to determine yield, showed two distinct peaks of production. Sixteen percent of the total yearly production of dry matter was made during April; while 20 percent, the highest peak, was produced in August. However, the dry matter contained 20 percent protein in early spring, and less than 12 percent protein in late summer. Such fresh pasture may be looked upon as a "watered" 20 percent protein feed in early spring, and a 12 percent protein feed in late summer. Supplemental feeding of livestock, especially milk cows or hogs, should take into consideration this seasonal variation in pasture composition. The variation in yields of permanent pasture makes it imperative, for nearly all classes of livestock, that some additional feed be provided to give a uniform daily supply. This may be supplemental grazing crops, hay, or other feeds.

Experiments conducted in Virginia more than 30 years ago showed that superphosphate aided in the control of broomsedge and weeds by increasing the amount of clover. Within the past few years experiments in every State and thousands of demonstrations have shown farmers that pasture is one of the most important farm crops. It has been shown to be a crop that responds profitably to treatment, especially to the use of plantfood, lime, and good grazing management. Few livestock farmers have too much feed even in this day of surpluses, and it takes an ample feed supply to promote quick growth and meet the present market requirements of high quality at lower

cost. Good pasture is the cheapest of all farm feeds for all classes of livestock. Pastures and other forage crops furnish more than 50 percent of all the nutrients fed to farm animals. In Missouri, for example, 65 to 75 percent of the farm income, exclusive of Government payments, comes from pasture farming. There is a significant relation between good pasture management, good livestock, and high farm income.

In spite of some of the South's natural advantages in livestock production and progress in pasture improvement, this region has not produced its proportionate share. The entire South, including Texas and Okla-



When a surplus of pasture occurs in the spring, it can be economically utilized as hay or grass silage.

homa, has 48 percent of the Nation's farms, 32 percent of the Nation's hogs, 30 percent of the Nation's cows and chickens, and only 28 percent of the Nation's sheep. But it has only 20 percent of the total cattle valuation. Delay in eradication of animal diseases, increasing difficulty with animal parasites, indifference to improvement in methods of breeding and marketing have all been retarding factors. A lack of appreciation of the quality of pasture and other forage feeds has resulted in livestock of low quality. Livestock in the bluegrass region of Kentucky and middle Tennessee, in the Shenandoah Valley of Virginia, and in certain other soil areas of the South are famous for their excellence. Animals thrive in those regions because the pastures contain plenty of all the nutrients essential to their welfare. In other areas animals thrive to the degree to which the soil has supplied the essential elements to the forages or other feeds. In earlier years when grain was relatively cheap, and especially when cottonseed meal was fed abundantly and soils were not quite so depleted, these differences were not so apparent.



Ewes and lambs enjoy improved pasture at Raleigh, N. C.

The areas where phosphorus deficiency exists are now known to include the Gulf coast, a part of the Atlantic coast, the middle South, and the extreme Southwest. The more acid and sandy soils, particularly in the Coastal section, may provide insufficient calcium, iron, copper, and cobalt, as well as insufficient phosphorus to the pastures grown in these areas. Manganese, while lacking in some rations for poultry and pigs, apparently is not generally deficient; neither is magnesium apt to be lacking in the ordinary farm ration. There is apparently no shortage of iodine in forages of the South; while sodium and chlorine, in the form of common salt, are generally supplied to all classes of livestock. Although boron, potassium, sulphur, and zinc have been proved necessary for crop production, they are not deficient in the ordinary rations fed to farm livestock. Neither is there any evidence in the South of an excess of selenium, which sometimes occurs in the Great Plains area, or of fluorine.

Where crop and pasture land are so managed and fertilized that an abundance of palatable and nutritious forage is produced for as many days in the year as possible, there will be little need by livestock for any mineral supplements other than common salt. Nor is there apt to be a shortage of any known vitamins if these good practices are followed.

Grass is called a perfect food. Very tender grass contains 23 times as much vitamin A as carrots, 22 times as much vitamin B₂ as lettuce, 9 times as much B₁ as green leafy vegetables, and 14 times as much C

as tomatoes and citrus fruit. About 12 pounds of dried tender grass would supply enough vitamins to last a man for an entire year.

But all that grows in pastures will not have the nutritive value described above. Early reports showed that legumes in general contained more calcium and protein and were considered of higher value for feeding than grasses. Recent reports show, however, that the same variety of legumes, grown on different soils, may give different results when fed to farm animals. This is being demonstrated by work at the Tennessee Experiment Station where red clover grown on fertile soil when fed to beef calves gave nearly twice the rate of gain as red clover grown on unfertile soil. Grasses grown on fertile soils may have higher feeding value per unit of dry matter than even legumes raised on poor land. Fertile alluvial land pasture in Louisiana produced an average of 5,068 pounds total digestible nutrients per acre, or the feed equivalent of 93 bushels of ear corn, 14½ tons of corn and soybean silage, and the equivalent in protein of 3,272 pounds of 41-percent cottonseed meal. Unfertilized but properly seeded flatwoods pasture, 50 miles away, produced only one-third as much dry matter, one-fourth as much total digestible nutrients, one-fifth as much calcium, and one-twelfth as much phosphorus per acre. Soil may influence quality to a greater extent than can at present be determined by chemical analyses.

Phosphorus applications at Holly Springs, Miss., resulted in almost twice as many pounds per acre of pasture forage that was richer in crude protein by 20



Well fertilized oats can be grazed during the winter and early spring, and still produce a good hay crop, as shown here at Willard, N. C.

percent and was grazed by the cattle in preference to unfertilized plots.

Fertilized pastures on one Virginia soil contained up to 39 percent more crude protein and 47 percent more phosphorus than untreated pastures.

The Kentucky Experiment Station found that lespedeza grown on certain limestone soils contained 0.32 percent of phosphorus and 1.28 percent of calcium; but when grown on soils outside the limestone area it contained only 0.14 percent of phosphorus and 0.89 percent of calcium.

Thus the effects on the animals using the pastures may be even greater than indicated by mere increase in yields of dry matter. Growth, development, reproduction, lactation, health, and soundness—all can be influenced to a marked degree by deficiencies or unbalances of the mineral content of the feed supply.

In Georgia, beef cows on permanent clover pastures treated with limestone and phosphate produced a 100-percent calf crop two years in succession. Only 50 percent of the cows on native unfertilized pasture produced calves. Steers gained 165 percent more per acre on improved pasture than on native unfertilized pasture. The finish and grade of the steers on improved pasture was also higher at the end of the grazing season. In more recent work, young mules on pasture treated with calcium and phosphorus gained 23 percent more in growth than mules on untreated pasture.

From every State come reports of preferential grazing of livestock on improved pastures. Even a blind horse in Ohio always found his way to the improved part of the pasture. Perhaps because the animals continually ate up the evidence of increased growth, we, too, have been blind to the differences in quality.

Dr. W. A. Albrecht, of the University of Missouri, stated recently: "That sick soils will not make healthy animals is particularly significant at this time. We are thinking on a national scale of combating soil

erosion by allowing much of the fertility-depleted soil to go back to grass. In our desperate search for varieties of plants that will exist on such soils, perhaps we have given too little thought to whether the forage so grown would be put by the cow on her list of dietary delicacies. Attention to the evidence of soil deficiencies as given by the dumb animals will react with profit both individually and nationally."

If continued progress toward grassland farming is to be made, we must change the old slogan, "Let more land go to grass," to the more logical one, "Help the land to grow more nutritious grass."

It has been said that the best kind of pasture is the half-acre you don't need. The best time to start a new pasture is nearly a year before it is to be used.

We need more effective use of farm pastures in all parts of the South to meet rising feed prices, increased dairy and livestock products for home market demands, and to fit into long-time crop rotations for stabilizing production after the war is over. It is late but not too late. At least one-half acre per animal of an adapted winter grain crop should be planted to furnish much needed grazing, to hold the soil against erosion during the winter, and to provide badly needed early pasture or hay.

In South Carolina records show that feed costs have been reduced one-third to one-half in winter in herds where winter grazing was available, but it takes suitable soil with sufficient available plant food, as well as early planting and cold-resistant crops, to supply better grazing.

Fall is the best time to fertilize permanent pastures in the South. It provides earlier spring grazing, enables grass to withstand winter conditions, saves feed cost, and better distributes farm costs. This year in particular, early fall delivery of fertilizer will avoid some of the later freight congestion that will occur as a result of defense activities. The Agricultural Conservation Program has made it possible for the farmer to apply lime and superphosphate very economically. Many pastures, however, are past the first stages of soil exhaustion and are now deficient in organic matter, nitrogen, potash, and lime. Complete fertilizer recommended by the State agricultural experiment station for the particular soil type may be profitable, where lime and superphosphate alone give only fair results. It is time to make judicious application of fertilizer to pastures to fit into the southern program of more feed production for livestock. Few farmers have too much pasture or too-well-fed livestock. When hungry grasslands are fed, livestock will thrive and there will be fewer hungry farm people.

Chris Olsen, Montana Farmer

By WILLIAM C. PRYOR ¹



Chris Olsen.

A MAN learns something from almost everything he does—if he uses his head. Chris Olsen of Montana uses his head. You might not think the experience a man could pick up as a machinist or an oiler on an ocean freighter would be particularly useful on a farm. But it made a good mechanic of Chris Olsen, and now he is able to keep all his farm machinery in first-class shape without help. It takes quite a lot of machinery to farm 480 acres.

Olsen used his head other ways, too. Last year he made a down payment to buy the 480 acres he had been renting for 13 years, and he did not have to put himself "in hock" to do it. He made this money selling crested-wheatgrass seed harvested from the buffer strips in his wheatfields.

That comes pretty close to eating your cake and having it too, because while the buffer strips were producing seed they were also protecting the fields from erosion and growing a good crop of palatable hay.

The hay helped Olsen to winter his cattle—25 head of beef cattle and a half-dozen or so dairy animals—practically without cost.

Naturally, Chris is "all out" for conservation farming, although there was a time when his enthusiasm was not as wholehearted as it is now—the time a "gully-buster" came whooping down across the Canadian line and washed out some of his new terraces, and the wheat crop with them.

As they tell it out at Culbertson, headquarters of the Froid Demonstration Project and Froid Soil Conservation District, some of the boys from the project office hurried out to Olsen's place the morning after this storm to have a look.

Chris met them at the gate with a black scowl on his face. Through some miscalculation, the rain had sluiced terraces and wheat down to the foot of the slope. Chris was perturbed.

Soon, however, after he had thought it over, he agreed to a revamping of the plans to guard against a repetition of the terrace-washing. Work was begun then on the new farm conservation plan that has resulted in the auspicious evidence visible today.

Chris Olsen is a Dane, and smart. Several years as a machinist in his native Denmark and as oiler on a cargo ship had convinced him that above all things he wanted to be a farmer. Shortly after World War I he came to America to try it out.

About 13 years ago he moved onto the land he is buying now, renting it from an absentee landlord. Naturally, he had the same troubles that other farmers in northeastern Montana had—some washing, considerable wind erosion at times, dry spells. Most of the farm was in wheat, which didn't help. The landlord insisted on this, because like most absentee landlords he wanted to make as much as possible off the land, regardless of what happened to the soil.

As conservation began to be talked about, Olsen became interested. He could see the topsoil blowing away and knew that something ought to be done about it. Then finally along came the Soil Conservation Service, establishing demonstration projects. One was set up in Roosevelt County, around the town of

¹ Division of information, Soil Conservation Service, Washington, D. C.

Froid, and Olsen's 480 acres were included. He signed up as a cooperator.

The experience with the heavy rain that washed out the terraces proved a set-back, but only a slight one. Quickly Olsen became as enthusiastic about conservation measures as the boys at the project office. He began to see with his own eyes the amazing results, both in protection of the soil, and in its improvement.

Numerous practices suitable to the northeastern Montana country were applied to the place. He planted a windbreak to protect his house and out-buildings—fine, thrifty trees and shrubs, in a country where such things cost a dollar a leaf; he plowed contour furrows in the pasture lands; he built a stock water pond; and, of course, he established those crested-wheatgrass buffer strips.

Olsen is a thorough believer in conservation, and the day I went to his farm with Art Emerson, information director of the Northern Great Plains Region, and "Hil" Riek, the district conservationist, the welcome we received was vastly different from the one he gave the project men the morning after the "gully-buster." "Hil" and Chris are close friends and have been for some time.

Chris is a little shy, but the warmth of his greeting was unmistakable. When we reached the place, he was pruning the trees in the windbreak of which he is so proud. He kept right on working, although at times he raised his head to give us quick glances from under his big straw hat. Chris is never loquacious, but what he lacks in volubility he makes up in sincerity.

When he looked at us and said solemnly, "Soil conservation? I think it's wonderful!" it was apparent that he meant what he said. He had tried hard to get conservation measures applied throughout the farm, using the theory that more of the land should be in grass and less in wheat; but the landlord was interested in cash crops, and held out for a good percentage of the acreage in wheat.

Finally Olsen began to entertain thoughts of buying the place so that he could farm it his own way. He knew that it takes more than thoughts to buy a 480-acre farm—it takes money—and then one day his eye came to a stop on the crested-wheatgrass buffer strips which the landlord had agreed to in order to reduce wind erosion. The heads of seed were beginning to develop. The big idea was born. The buffer strips had a good stand of wheatgrass and would produce a considerable amount of seed. He knew that this grass was being "pushed" in conservation work throughout

the region. There probably was a market, Olsen thought, for a lot of the seed. So he set to work.

He knew that it would be necessary to clean the seed, and it was here that he brought into play his mechanical skill to add a few refinements to his combine. When the seed was ripe he harvested it and ran it through the combine to clean it.

That first year his total yield of seed was 400 pounds per acre. In 1940 he harvested and sold 11,000 pounds.

Nor did he sell the whole lot to a dealer or a seed company. He sold it at retail direct to the users—his farmer neighbors. The cleaned seed was sacked and loaded into his wagon, and he set out—a house-to-house salesman of crested-wheatgrass seed.

He well knew that not all of the farmers in northeastern Montana were convinced, as he himself was, of the value of crested wheatgrass as a soil-holder. But he was ready for them—he took along evidence. On the seat beside him was a fresh green plant of the wheatgrass to show what excellent green forage it made, with some wheatgrass hay to show how good it was as winter forage. Finally, he carried a whole clump of crested wheatgrass, roots and all, to show the farmers how admirably fitted it was to hold the soil in place.

He sold the seed. Occasionally some skeptic would claim that the exhibits were handpicked from special plots rather than at random from the fields. Chris always invited these doubters to his farm and took them out to the fields and pulled up a few clumps. Generally, they were convinced.

Within a few weeks Chris Olsen walked into the bank with the money for the down payment, and began farming his 480 acres his own way.

His own way is a little different from that of many farmers in his neighborhood. For instance, Chris states flatly that every farmer in that section of the country should have one-third of his land in grass at all times. That is what he is working toward on his own farm.

Olsen says that there has been no blowing of soil on his farm in the five years since he started applying conservation practices to the land, which means since the demonstration project was established, and he intends to continue contour and straight strip-cropping.

The rotation now established will be followed, leaving part of the land in grass for 5 years and then plowing it up, but never plowing up the established grass until the new grass plots in the rotation are started.

Already he has decided on a few changes in field

layouts to improve operations; but he indicated that these changes would wait until it was time to make the change under his normal rotation plan. Chris considers it extremely important that each acre of land should be in grass 5 years out of every 15.

Crested wheatgrass and wheat are not the only crops Olsen grows. Under his flood irrigation system he has four acres of alfalfa that has been yielding about 5 tons of hay per year. As for hay, that same crested wheatgrass is good, too, when cut at the right time—"about as satisfactory as alfalfa hay," he declared.

He has a stack of wheatgrass hay about as long as a city block, which has proved a blessing during the winter months for feeding the stock. In addition to this hay, his stock was given winter grazing on the crested wheatgrass growing in a field adjoining the barns, and they came through the cold months in fine shape.

For that matter, he grazed his crested wheatgrass during spring and autumn too. Crested wheatgrass pasture has a carrying capacity of a cow and a calf per acre in early spring and late autumn, and Olsen used his that way for a total of 5 months in the year.

No wonder Chris likes crested wheatgrass, and no wonder he is now reserving a special plot on the place where he will grow wheatgrass seed. This will afford him a permanent source of seed without interfering with his rotation of 5 years out of 15 in grass.

No wonder that Chris Olsen is pleased with conservation farming. It has enabled him to build up a reserve feed supply on a farm that would be the envy of almost any farmer—enough to feed his stock, his chickens and his turkeys. Not just for a few weeks, but, as he himself expressed it, "Even if the wheat should fail, we're fixed now so that we could get along all right for a year or two."

Chris Olsen is pleased, but he is not satisfied. He still is looking for a better way to do things—for instance, a better way to grow wheat and barley, or to put it the other way 'round, a way to grow better wheat and barley.

During the last few years he has been conducting some unusual and carefully planned experiments along this line. First the barley: He planted it in rows 24 inches apart and cultivated it, instead of drilling it in. The results were worth while, he thinks. The barley from the wide-row fields which he has stored in his bins is almost like wheat with its full kernels and heavy weight, and Olsen likes to show it to visitors and compare it with barley grown the old way—a sack of which he keeps for such demonstrations.

Now for the wheat. It was somewhat dry in northeastern Montana 2 years ago, but Chris found



Crested wheatgrass is the No. 1 grass for fat cattle and safe soil in Prairie County.

that the wheat planted in rows 24 inches apart, and cultivated, yielded 18 bushels of No. 1 wheat per acre; while wheat drilled in the ordinary way yielded only 11 bushels of No. 3 wheat to the acre.

Chris is not one to jump at conclusions. Asked if he was going to continue the practice, he looked thoughtful. "I want to do some more testing before I make up my mind about the wheat," he said. Chris is too smart to pass up any opportunities and too intelligent to make flash decisions.

(Continued on p. 126)

Conservation Practices Receive Approval of Bankers

Bankers are practical people. They do not jump at conclusions, do not take to fads or new ideas unless they see dollars-and-cents values—if they did they would not long be bankers. From the stacks of letters reaching the Service yearly, these from bankers in various parts of the country are quoted as definitely indicative of the monetary value of soil and water conservation methods. In a way, these statements constitute an important message to the farmer from the banker, by way of the Soil Conservation Service.—Editor's Note.

The cashier of the Springfield State Bank, Springfield, S. Dak., writes to the directors of the Emanuel-Choteau Creek Soil Conservation District:

One of your cooperators came to us for a loan on his corn crop. The writer personally has watched this field with much interest. His crop had been farmed on the contour. As we knew that he would harvest a good yield, we made the loan and after harvest it was paid in full. We found that this gentleman had a yield of over 20 bushels of corn more than any of his neighbors.

During these past 10 years of extremely dry weather, practices of saving the soil and conservation of land have been most important. From the standpoint of the banker, I regret that your soil office was not with us during all of those 10 years. However, I feel that you are now doing a great work along conservation lines; your soil survey of this area will be most valuable in the years to come. Your practices have aided the credit of our farmers.

Elvin C. Bjorklund, District Conservationist of the Sioux-Brule Soil Conservation District, Alcester, S. Dak., received a letter quoted in part from E. F. McKillips, cashier, State Bank of Alcester:

You will recall that we mentioned to you about 2 weeks ago a favorable experience in connection with an unimproved 80 acres which you have placed under a complete soil conservation program. We thought perhaps you would like this information in your files.

This bank, as you know, makes real-estate loans for life-insurance companies. We had a customer who desired to buy the 160 acres that he was renting, at a cost of \$12,000. In order to make this purchase, it was necessary for him to float a real-estate loan for \$10,500 on the improved 160 acres which he was purchasing and the unimproved 80 which he owned.

The outside limit which this man could borrow on the 160 acres was \$8,000, and the inspector for the loan company would agree to this amount only on a condition that certain soil conservation practices be established on this farm, including the building of a dam.

The 80 acres had to carry a loan of \$2,500. This is a rough farm with a creek running the whole length, and under ordinary farming practices it would not be eligible for a real-estate loan of any kind. However, because this eighty could be tied in with the 160 acres with homestead already established, and because of the soil conservation practices in use on the smaller area, the loan company inspector agreed to a \$2,500 loan, which gave the man the desired loan of \$10,500 on the whole 240 acres.

The water control on the eighty, consisting of a well-constructed dam, contour farming and crop practices saved the day for this farmer.

This statement by D. F. Patterson, cashier of Palmetto Bank, Laurens, S. C., comes from the files of T. S. Buie, Regional Conservator, Southeastern Region, Soil Conservation Service.

Since we are located in an agricultural county we feel that it is our responsibility to finance the farmers of the surrounding territory. Applications for loans come from all types of farmers—successful, fair, and those on the border line. In approving agricultural loans we must make an appraisal of the character, ability, and capacity of the farmer. Many farmers do not have the highest rating on all three requisites, and other factors need consideration. One of the finest recommendations for a farmer is the presentation to us of a well-planned soil conservation plan and reasonable assurance that it will be carried out on the particular farm. This farmer can be granted credit where another farmer under similar circumstances but without a conservation plan could not receive the same assistance. From our experience we have found that the loan to the farmer who carries out a well-planned conservation plan has the least element of risk.

J. B. Barnett, president of the Monroe County Bank, Monroeville, Ala., writes of his county's farms in a letter to Regional Conservator Buie:

I have observed with considerable interest the splendid work that you are doing in this county to conserve and improve our soils.

The three banks in Monroe County of which I am president have a deep interest in any movement or program that looks to the rehabilitation of our worn and washed off land, and as these banks do a major part of their business with farmers, we are at all times willing and anxious to extend credit and a helping hand in any program that will enable our customers to improve their farms because it enhances their value and increases the income derived therefrom.

I trust that you may be permitted to carry on your work in our county for a long time, and that the CCC will be able to prolong their stay in our midst and carry on this work until our farmers learn to put into practice the things you and your associates are teaching them and demonstrating to them.

This county has been almost entirely an agricultural county since it was first settled something like 150 years ago, and in the future as well as in the past it will be necessary for our people to look for their prosperity in enriched soil and better farming practices.

This statement was made by J. Worth Morgan, manager, Forest City Branch, Union Trust Co., Forest City, N. C.:

In our hilly Piedmont country, the first requisite in building a rich, productive soil is the proper use of soil conservation practices. It is folly for a farmer to buy expensive fertilizer or endeavor to enrich his soil by the growing of legume crops, unless he first conserves his soil. With the aid given the Soil Conservation Districts by the United States Department of Agriculture it is now possible for all of our farmers to have their farms planned so that the soil and moisture losses will be reduced to a minimum.

Soil conservation cannot very well be valued in dollars and cents. One must look out into future years, as the land regains fertility, produces bigger crops and higher farm income with less work and expense.

The banker is especially interested in soil conservation because he realizes that agriculture is the very backbone of all industry. Business is always good in the city or town surrounded by a rich agricultural community. The farmer who conserves his soil always finds credit more easily obtainable from the bank than his neighbor who permits his valuable soil to wash away.

Adam Lockhart, cashier of the Bank of Wadesboro, N. C., is also an active cooperator of the Brown Creek Soil Conservation District with headquarters at Wadesboro. Conservation plans have already been developed for three of Mr. Lockhart's farms in Anson County, covering 2,880 acres, and he has applied for a conservation plan on another farm embracing approximately 1,000 acres. He is a breeder of purebred Hereford and Jersey cattle, and in addition to crops for feeding livestock and improving the soil, he raises about 300 acres of cotton each year.

As a banker vitally interested in the welfare of agriculture, Mr. Lockhart says:

We consider a district cooperator a much better credit risk than he would be were he not a cooperator; and the closer he cooperates in carrying out his plan, the better credit risk he is.

Farmers do not give enough attention to investing for the future and building for permanency. So many steal from themselves by spending money for nonessentials that should be spent in improving their farms. Money spent to improve and conserve the land is always a safe and sound investment for the future.

I consider the development of permanent pastures and hay crops as especially desirable from an investment standpoint since returns are paid over a long period of years and the soil is conserved during the time.

L. M. Grimes is vice president of both the Industrial Bank of Lexington and the Commercial Bank of Lexington, N. C. In addition, he operates a large roller mill and a feed and fertilizer business. Daily he meets farmers and talks with them.

Speaking of soil conservation, Mr. Grimes said, "Many farms were washing away and this brought about lower crop yields and lower land values. There was need for a program that would control this erosion, help to build up the farms, and make more money for the farmers. I believe that the type of work done by the Soil Conservation Service is needed and that it is money well spent.

"Naturally a banker would prefer to loan money to a farmer who was trying to build up his farm and keep it from washing away."

Mr. Grimes stated that farms with a large amount of idle land are not very good risks for loans. "The idle land should be put to work," said Mr. Grimes. "Where there is very much idle land on a farm everything is going out and nothing is coming in. A man can't pay back a loan on this type of land and I would not recommend much of a loan on farms like this."

B. Datin, vice president of the Farmers State Bank, Faith, S. Dak., apparently is one of those bankers who keep up to the minute on soil and water conservation practices. He writes to I. T. Hermanson, district conservationist for his area, as follows:

In 1934 and 1936, we experienced very severe droughts. At that time quite a number of our customers depended entirely on open water for their livestock. During those 2 years, in different

parts of our territory the water holes dried up and creeks went dry, and as a result considerable livestock had to be shipped out of the country.

At this time we have around 300 dams that we did not have in 1934 and 1936, and regardless of the severity of any drought we might have in the future, we feel that these dams are going to furnish all the stock water we need. Naturally we feel that our range loans are much safer than before these dams were built.

Also we believe that the spreader systems constructed here will greatly increase hay production and enhance the value of the ranches on which they are built.

J. H. Morgan is vice president of the Opelika National Bank, Opelika, Ala., and chairman of the agricultural committee, Alabama Bankers' Association. He visits farms, talks with farmers, sends us this statement:

I recently visited some of the farms in south Alabama that were planned by representatives of the Soil Conservation Service. I found in effect on these farms programs that will conserve the soil, establish permanent farming systems, produce more food and feed and thereby raise the standard of living of the farmers. These plans, or the method of farming outlined in them, offer the brightest ray of hope I see in the present agricultural outlook: they offer the farmer a chance to get away from the one-crop system that has been such a curse to the South.

Since my trip I have talked with numbers of farmers and bankers about the program of the Soil Conservation Service and they invariably were enthusiastic about it.

It is my opinion that if farmers will carry out the type of plans made by the Soil Conservation Service their income will be doubled or tripled in 5 years.

I would consider a farmer who is carrying out one of the plans on his farm, or practices similar to those generally recommended in the plans, a 50 percent better credit risk than one who is following our old one-crop system. I would further consider him a good credit risk because he has a definite plan and a goal toward which he is working. This goal will in the end mean better land, more and better livestock with increased farm income. I like the plans because they are made with the farmers for their individual farms.

The district approach to the conservation of our soil appeals to me because it stimulates the interest of the farmers and makes them feel that they are a part of the conservation program.

On my trip to south Alabama I saw many acres planted to kudzu and sericea lespedeza. If the hundreds of thousands of acres of idle land in Alabama were planted to these crops it would mean a tremendous financial uplift to the farmers of the State.

It is our intention, as the agricultural committee of the Alabama Bankers' Association, to build our program around soil conservation. We believe that the bankers have a place in this program along with the farmers.

W. D. Malone is president of the First National Bank of Dothan, Ala., and past chairman, agricultural committee, Alabama State Bankers' Association. He knows that the future of his 40-year-old bank is dependent upon the productivity of the farm land of his community. He sends us the following letter:

This bank recently employed a man whose sole work is to encourage better farm management and methods among our customers. We often send him out to make a survey before we pass on an agricultural loan. The first question we ask him is "How is that farmer keeping up his place—the land as well as the buildings?" We want

to know about terraces, the quality of the soil, and if we can reasonably expect that soil to maintain its fertility over the period of a 5- or 10-year loan.

We realize that a tremendous amount of energy, earnest endeavor and personal interest in an organized way is going to be necessary to handle soil conservation properly. Our observation is that soil conservation is often a community's problem rather than a problem for one particular man's farm. We are much impressed with the start that has been made in our particular section and community in respect to what we know as the "districts movement." The problem cannot be solved independently or individually, but is going to take much cooperation and scientific planning.

CHRIS OLSEN, MONTANA FARMER

(Continued from p. 123)

This intelligence carries over into every phase of his farm work. I have seen—and so have you—many a farm where the machinery sits out in the barnyard or by the side of a field, rain or shine, and receives little or no care. Not on the Olsen place. Chris gives every piece of machinery on the place a thorough going over at least once every other year—oftener if necessary. As he is an experienced mechanic he can do it, and he has a heated building spacious enough to permit work on all his machinery during the winter months when outdoor work is slack.

His farm machinery is Chris Olsen's weakness, if he has one. Sometimes he will guide the visitor to a long row of farm machines of various types lined up against a fence near the house, his own private outdoor museum of farm equipment.

"That is my first walking plow," he will point out. "And my first sulky plow, and my first gang plow."—and so on, down to the end of the line. These machines, no longer used, are kept as mementos of his farming progress.

Mrs. Olsen has no objections. She is glad, however, that he doesn't try to bring them inside to clutter up the house.

TOOLING UP FOR SOIL CONSERVATION

(Continued from p. 116)

ventional equipment. Some are shovels attached to standard terracer blades that cut a furrow and spread the spoil bank in one operation. Others are modifications of standard listers with the moldboard or the wings of the share removed or cut. Sometimes damming devices are attached to these same furrowers. For use in heavy sod, a contour furrower has been developed that cuts the furrow without disturbing the sod. This implement is made in a reversible model.

In the field of irrigation agriculture, new machines

save soil and water. For orchard use, among the most promising are those for constructing broad, shallow irrigation furrows. These furrows have numerous advantages over the old narrow V-type in that fewer roots are severed, a better distribution of water is obtained, and erosion damage in the furrows is greatly reduced. Other devices such as disk ridgers are also finding wider application in this work.

Improved nozzles and land leveling devices have helped conserve water and minimize erosion in sprinkler-irrigated areas.

Other new developments and improvements in agricultural equipment have helped make soil conservation farming easier, cheaper, and more practical. The increasing use of pneumatic tires and power-controlled implements has simplified the maintenance of permanent grass in waterways and other vital areas. Improvements in electric fencing have made it easier to control and defer grazing. Light, maneuverable tractors with adjustable hitches have facilitated farming on the contour and on small, odd-shaped fields. Stronger spreaders have advanced the use of marl; and other machines, such as the V-bottom trucks equipped with spreaders, have made liming easier and cheaper.

The list could be extended indefinitely. Progress is so rapid that it is difficult to keep abreast of the products of the American genius for invention and gadget-making that have an application in conservation farming. The development of farm equipment is following close on the heels of the conservationists. Whenever there is a new need or a new practice that will help in the husbanding of farm resources, American craftsmen will, as they have in the past, make a machine that will do the job. With the help of equipment manufacturers and agricultural technicians, the American farm plant is tooling up for whatever demands the future may thrust upon it.



Separating Bermuda grass roots from soil with new type shaker.



CAN FARMERS AFFORD TO GROW THEIR POWER ?

At the Percheron Judges and Breeders Conference at Frederick, Md., July 21-22, 1941, Professor Ensminger of Massachusetts State College put the question as to what profitable market there may be for the 40,000,000 acres of cropland formerly used to feed the horses now displaced by automobiles, trucks, and tractor. His question can be answered, temporarily at least, by pointing to the increased demand for food in our defense program; and certainly a lot of those acres that were being plowed needed to be put to some less intensive use such as the growing of grass or trees. Professor Ensminger also commented on the scarcity of convincing information on the subject and cited the results of actual farm studies by the Illinois and Iowa Agricultural Experiment Stations.

The financial aspects of this change to tractor farming in these two Corn Belt States are favorable to home-grown power. This is borne out by Farm Security findings in Fayette County, Iowa, in connection with administration of tenant purchase loans: On 15 farms averaging slightly more than 100 acres there was a difference of 91 cents per acre between gross income and operating costs in favor of the use of horses.

Over a 10-year period in Illinois, on 6 tractor-operated farms averaging 171 acres, the total cash expenditures for farm power and machinery amounted to \$2,850. On another group of 6 similar farms averaging 163 acres, but horse-power operated, cash expenditures were only \$1,190. The difference of \$1,660 over the 10-year period amounts to an average of \$1.02 per



acre annually in favor of the use of horses.

Obviously, horses must continue to play a part of national importance in doing our farm work, and in making use of the greater production of pasture and meadow crops necessary in soil conservation. Horses help in teaching boys to appreciate livestock; they are a source of recreation. What is more, these well-loved animals will continue to serve in the Army for the defense of democracy.

Professor Ensminger's address appears in the September 1941 issue of *The Cattleman*.—A. T. Semple.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

SOIL CONSERVATION DISTRICTS IN ACTION ON THE LAND. By Glenn K. Rule. U. S. Department of Agriculture Miscellaneous Publication No. 448. Washington, D. C. July 1941.

The Service collaborates with soil conservation district supervisors to produce this bulletin showing vividly how the farmer-does-it-himself idea has worked out on the land after 4 years of energetic effort. Study and planning and effort, one should say; because there has been a great deal of getting together on the part of more than a million and a half farmers with State and Federal and local technicians for intensive areal studies so that soil conservation through these local governmental units might be successful and permanent.

Mr. Rule uses the device of the specific example to show how and why, within so short a time, the soil conservation districts have spread over a quarter of a billion acres of American farm land, to show how these districts function, and what they mean to the future of our country. Out of 450 districts he has chosen two, very far removed from each other, for detailed description. One is a goodly slice of the State of North Dakota; it is called the Cedar Soil Conservation District. The other is 'way down in the Cotton South—the Terre Rouge-Bodcaw District in southwestern Arkansas—over a million acres of cotton land, timber, lakes, streams, roads, and towns. As told by Mr. Rule the story of farmers "doing it themselves" in these two immense blocks of land is intensely interesting because it shows the people on the land taking advantage of an opportunity to change farming systems and incorporate conservation methods and practices. The fine illustrations help greatly to point up the story. It is to be hoped that this bulletin will be widely distributed.

COMMERCIAL FERTILIZERS, THEIR SOURCES AND USE. Third edition. By Gilbeart H. Collings, Philadelphia, 1941.

Every year, every season, farmers of this country realize more keenly that they cannot use soil-fertility materials by the guess-and-hope-for-the-best method. This third edition of an important book, following within three years the second edition, is one more "sign of the times" and the rapid progress in all problems concerning fertilizers and their use in securing larger yields of field and nursery crops. Much new material is now included to aid plant nutrition specialists, and as helps to growers in understanding the necessity for replacing plant nutrients lost through cropping, leaching, and erosion.

Aside from its wealth of practical information on availability and uses of commercial fertilizers, the book now can be said to be built around the thesis of our own needs in the matter of plant nutrients: Can the United States ever become self-sufficient in its fertilizer requirements? Can our soils be restored, while we grow and harvest tremendous amounts of food and feed crops, and kept thereafter in a high state of fertility to meet growing demands on the land?

Judging from Professor Collings' account of the origin and development of the use of commercial fertilizers, the industry in its early days consisted chiefly of digging up great parts of the planet's "skin," transporting them across broad oceans and mixing

them with other parts. Today the situation is changed; world production and reserves of fertilizer materials are being estimated; consumption rates are receiving attention; experts begin to talk of a saturation point for fertilizers. It seems that there is, or ought to be, such a thing as conservation of soil-fertility materials as well as of soils.

Thus, particularly because of production trends in the United States as related to conditions in other countries, it is most important that users of fertilizers know what they are using and have more than general knowledge of the effects upon plant growth and soils. For the student's convenience, Professor Collings has arranged the essential nutrient elements taken from the soil, other than nitrogen, phosphorus, and potassium, into two groups. In this edition he includes a new chapter on the manufacture and use of the ammonia solutions.

The nitrogen carriers are treated in great detail as to sources and relative values for field crops. The "synthetics" are given a complete chapter, with information as to how they are manufactured, their uses when applied to crops, their characteristics in storage and transportation, their effect upon the soil, their uses other than as soil-fertility materials, how to apply them and the precautionary measures to observe before applying.

The author also gives especial attention to the rarer essential nutrient elements required by field and horticultural plants. Two long chapters present the principles underlying the purchase and use of fertilizers, and directly following are some practical directions for applying fertilizers for special purposes—germination, seedling growth, for economical yields, for fish ponds. The book has both an author index and a subject-matter index, so that with the extensive bibliography as further aid, the person using it either as a text or as a reference has no difficulty in finding quickly the information needed, or in checking the many different commercial fertilizers as to source, availability, uses and application methods.

METHODS OF ANALYSIS OF THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS. Fifth edition. Washington, D. C.

This valuable "Book of Methods" keeps up to date in a changing world, thanks to the vigorous, now famous, association from which it first emanated some twenty years ago. The handbook now contains over 750 pages—a far cry from the 50 printed pages of its first issue.

The volume opens with methods of soils analysis and follows up with fertilizers and agricultural liming materials. Chapter 11 gives official and tentative directions for sampling and analyzing plants for the various chemical constituents, while a chapter farther on—chapter 27 to be exact—is devoted to methods of analyzing grain and stock feeds for moisture, ash, proteins, nitrogen, fat, minerals, etc. Two chapters contain microbiological and microchemical methods. Chapters 3 and 5 are left blank to be inserted in another edition, probably, after the Association has studied "Sewage" and "Agricultural Dust."

The large part of the handbook is given over to official and tentative methods of analyzing specific agricultural products. Foods and drugs are extensively treated. The 25 reference tables included at the end of the methods are indispensable in the chemical laboratory.

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



Field offices should submit requests on Form SCS-37, in accordance with the instructions on the reverse side of the form. Others should address the office of issue.

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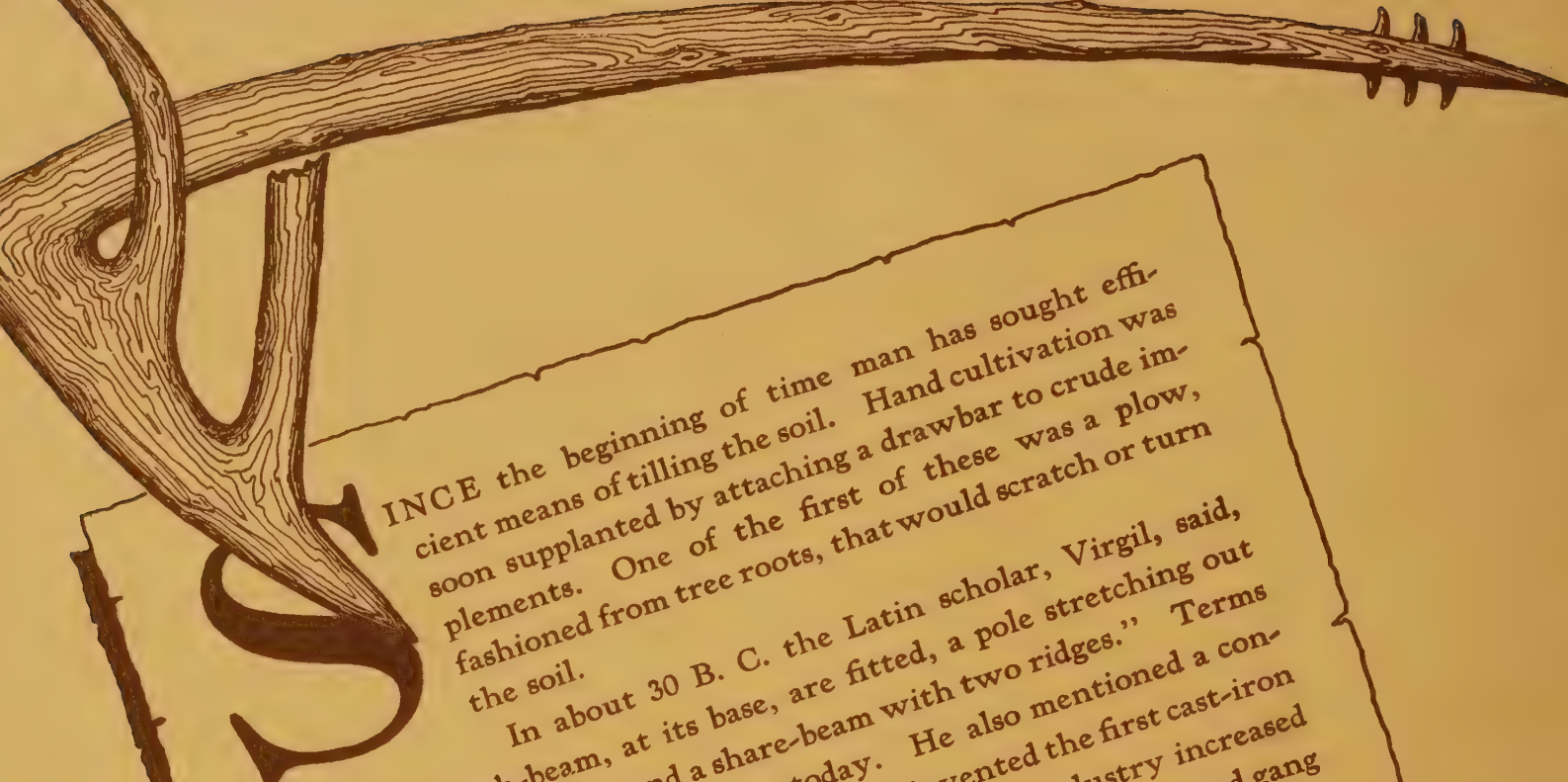
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¹ Prepared solely for use by the Soil Conservation Service and official cooperators.

² From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

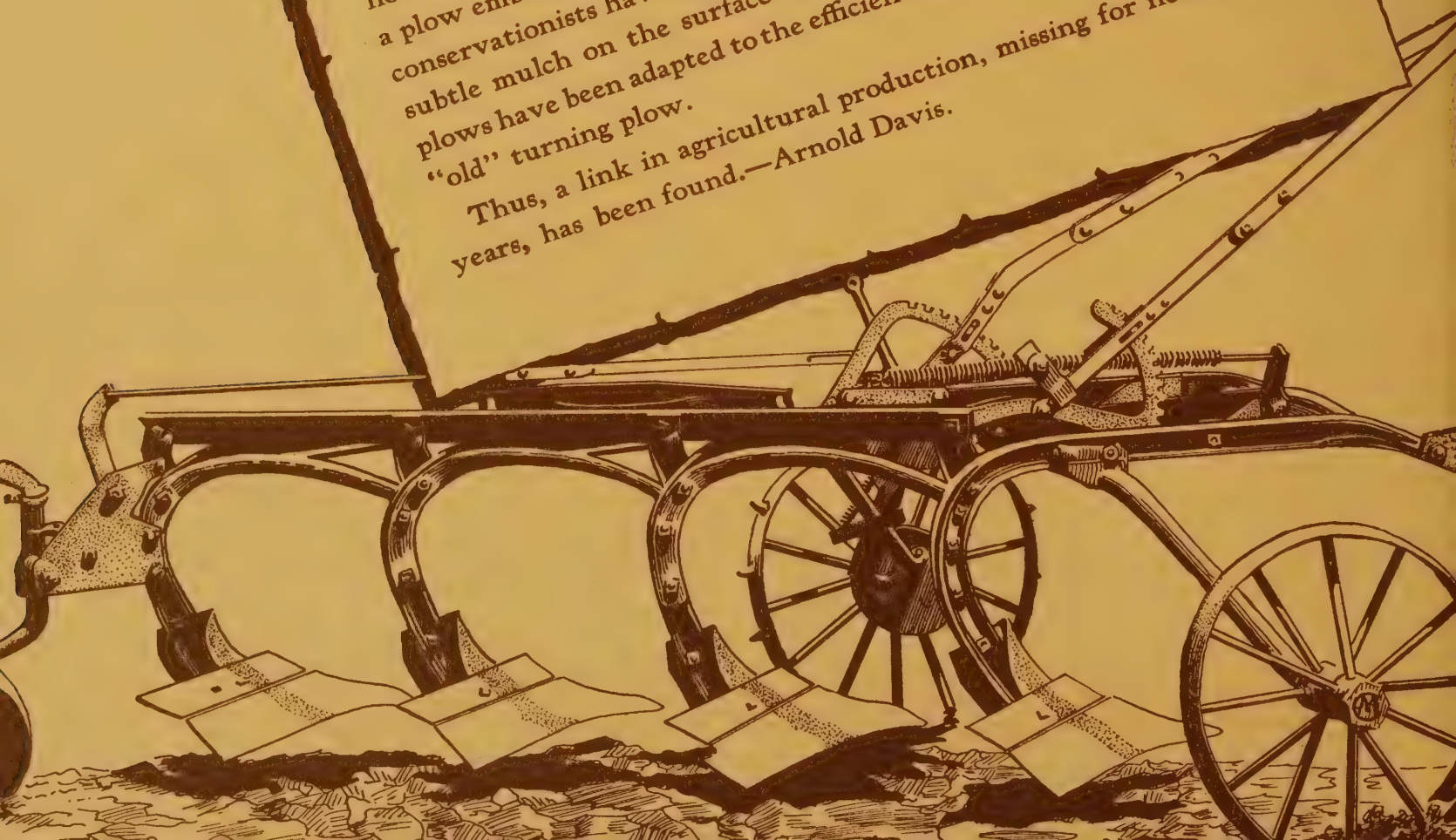


SINCE the beginning of time man has sought efficient means of tilling the soil. Hand cultivation was soon supplanted by attaching a drawbar to crude implements. One of the first of these was a plow, fashioned from tree roots, that would scratch or turn the soil.

In about 30 B. C. the Latin scholar, Virgil, said, "To this plough-beam, at its base, are fitted, a pole stretching out 8 feet, two mold-boards and a share-beam with two ridges." Terms in this quotation are still in use today. He also mentioned a four plow designed to turn the soil over. American industry increased the efficiency of farming operations by developing tractors and gang turning plows.

As the country became erosion conscious, it was evident that tillage practices and implements must be changed. A plow was needed that would leave crop residues on the surface to prevent erosion, hold the moisture and mellow the soil. A Georgia farmer developed a plow embodying these principles known as "the scooter." Other conservationists have developed plows that leave a trashy cover or subtle mulch on the surface in grain fields. These conservation plows have been adapted to the efficient gang principle used with the "old" turning plow.

Thus, a link in agricultural production, missing for nearly 2,000 years, has been found.—Arnold Davis.



December 1941

BAILEY REPORTS ON
PERENNIAL FORAGE
IN DADEVILLE AREA

A vertical illustration on the left side of the page depicts a scene of agricultural pioneering. It shows two covered wagons being pulled by teams of oxen. The oxen are shown in profile, harnessed together. The wagons have large, rounded roofs. The background is dark with horizontal lines suggesting a field or trail.

SOIL CONSERVATION
OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Dr. Bennett returns from a journey along the trails of the covered wagon with a narrative, eyewitness account of agricultural pioneering. Out where the West begins—and beyond, to the Pacific—farmers are learning to conserve the riches of the good earth and the bounty that drips from the skies.

UNITED STATES DEPARTMENT OF AGRICULTURE — WASHINGTON

CONTENTS

Conservation Along the Oregon Trail:	Page
By H. H. Bennett.....	129
Conservation Goes on the Air:	
By F. A. Rankin.....	135
Principles Affecting the Control of Erosion in Road Cuts and Roadside Ditches:	
By J. W. Johnson and Hugh A. Brown.....	138
A Pasture That Does Not Take "Annual Leave":	
By Glennon Loyd.....	140
Check-Up on Perennial Forage Plants:	
By R. Y. Bailey.....	142
Photographic Method of Preparing Farmer- District Agreement Maps:	
By W. F. Beamon and M. S. Kennedy.....	146
A Double Check on Erosion:	
By M. E. Mortimore.....	150
Book Reviews and Abstracts:	
By Phoebe O'Neill Faris.....	152
For Reference:	
Compiled by Etta G. Rogers.....	Opposite 152

Front and Back Covers
By Katharine R. Johnson

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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DEC. • 1941

CONSERVATION ALONG THE OREGON TRAIL

By H. H. BENNETT
Chief, Soil Conservation Service

WE didn't follow precisely the trail of the covered wagons or even in the footsteps of Lewis and Clark. But our zigzagging journey took us back and forth between them on the general course of the Oregon Trail, across prairies, plains, mountains, interior basins, and plateaus, to the Satsop and the lower Columbia. We deviated freely, because we wanted to see various types of farming country, study local problems, and learn what farmers are doing toward their solution.

Along the way we talked with numbers of farmers cooperating in soil conservation district work, conferred with district supervisors, and noted the recovery of grass in Plains areas that were desperately dry, dusty, and barren when I saw them during the disastrous drought of 1936.

We started with the 235,000-acre Turkey Creek Soil Conservation District which sprawls in the rolling country about Pawnee, in southeastern Nebraska. And right away we ran into a demonstration of stubble-mulch seedbed preparation, on the farm of Charles Glasgow. Here were being used a variety of subsurface tillage machines, all recent inventions, most of them a practical aftermath of the joint research studies of F. L. Duley of the Soil Conservation Service and J. C. Russel of the Nebraska Agricultural Experiment Station.

Many farmers were on hand. Obviously they were alert to the importance of this new agricultural practice. We rode with Everett Barr, chairman of the supervisors, as we observed the effectiveness of conservation work in various parts of the Turkey Creek district. Corn on the contour we found to be outstandingly better than that grown where too much of the rainfall had run to waste.

Finally, we came to what someone said was one of



A. H. Sibbernson and the Chief of the Service examine a seedbed prepared by a subsurface tillage machine. The previous crop of small grain had been combined. Note abundance of straw and stubble left on surface to prevent erosion and to increase absorption of rainfall.

the largest fields of brome grass in the country. It was a beautiful sight, 640 rolling acres clothed with an unbroken carpet of nutritious grass, seeded on the contour. Erosion was completely under control, and the tract was yielding excellent net returns from the

sale of livestock and seed. This year the seed alone sold for \$7,500 cash. How's that for "just grass seed?" Two hundred head of cattle were grazing in the field while we were there—and there was abounding grass for all.

I am convinced that the farmers in the Turkey Creek District, as well as most farmers thereabouts, like the conservation program of the district and the district's democratic way of doing things. What they tell you—and how they tell it—about the saving of soil and water and about increased yields and increased income gives you that impression. And what they have done to expand the district boundaries indicates enthusiastic and continuous approval—pretty nearly unanimous approval.

The district started off with an area of 62,000 acres. Some farmers at first couldn't make up their minds they wanted to be included, so the boundaries were drawn to leave them out. Many of these subsequently petitioned themselves in. Actually, by petition and ballot, 173,000 acres have been added to this district under 28 separate petitions, and there are petitions for still more additions in the making. With that kind of growth—from 62,000 acres to 235,000 acres over a brief period of time—one suspects that the germ of soil and water conservation has found a favorable seedbed in the minds of men tilling the erodible lands of southeastern Nebraska.

After Turkey Creek we spent some time with Duley and Russel themselves, studying their findings on stubble-mulch practices near Lincoln.

Some people find it difficult to understand "research." It may be the word was an unfortunate selection for such a simple endeavor as using human brains to search out new and better and cheaper ways for doing things—such, for example, as making a living out on the land where man must cooperate with his neighbors, his livestock, his plants, his soil, with rainfall and temperature, with tax gatherers, and with nature.

At any rate, Duley and Russel, experimenting with the inter-relationships of soil, water, vegetative cover, and plant growth, have found simple, usable ways to increase vastly the intake of rainfall, and to reduce materially the loss of soil moisture by evaporation. Furthermore, they have developed machines, in cooperation with farm implement manufacturers, which accomplish the subsurface tillage that is requisite to a stubble-mulch system of farming. Still other implements are being developed to improve the seeding of grain and cultivating of corn under this system.

These recent developments, which have counter-

parts in other regions, represent an epochal advance in the physical aspects of agricultural practice. Stubble-mulch farming completely reverses the old system of turning under all protective covering of vegetation—corn stalks, cotton stalks, wheat stubble, everything. It effectively challenges the "turn under" method which wasted its opportunity to store up rainfall and reduce erosion.

Here are a few reasons why I feel this way of plowing—leaving at least part of the vegetation as a protective cover on the surface—is the right way:

1. At the Clarinda, Iowa, soil and water conservation experiment station the highly important Missouri Valley loessial soil, Marshall silt loam, has been losing by erosion 32 tons of rich topsoil annually from continuous corn land, along with a sixth of all the rainfall, as run-off; whereas, from the same kind of land with a good stand of grass only .02 of a ton of soil has been lost annually, and only one-fiftieth of the rainfall.

2. Under the Duley-Russel system, 54 percent of the rainfall was stored in soil surfaced with 2 tons of straw per acre, and tilled by subsurface methods, as against only 20 percent conserved under ordinary summer fallow and 27 percent under basin listing.

3. Farmers in steadily increasing numbers are adopting this new technique. They like it, I was told, because of its value for controlling erosion and because of its good effect on yields and farm income. One farmer has invented and patented an excellent subsurface tillage machine to go with stubble-mulching—a machine which I saw in use on a farm near Broken Bow.

Before leaving the experiments of Duley and Russel, who spent about two hours showing us their work, I want to add another observation about their method of experimentation.

They are making exact measurements of water intake, run-off, etc. on many small plots. From these plots they move whatever shows promise to areas of field size for further checking before making final recommendations to farmers. This plan of carrying the results of investigations from little plots to big plots (field size) and then out into general farm practice—to the point where the farmer harvests his increased or his decreased yields—takes the scientist to the real end of his experiment.

This method of carrying experimental work right up to the farm harvest is the master pattern that governs all investigations of the Soil Conservation Service. It means that our program of research is based on the needs of practical farming; no project is



*The Tetons rise majestically
from the shores of Lake
Jackson.*

(Department of Interior photograph)

considered through until the field results are added up.

We saw many phases of soil and water conservation work in a number of districts as we drove westward. There were 30 districts in Nebraska at the time, covering 6,500,000 acres.

Progress was being made everywhere. This year the farmers we talked with were particularly pleased with the better corn being grown on contoured land.

We saw contoured corn on the farm of Albert Watson, one of the supervisors of the Wayne Soil Conservation District, near Wayne, Nebraska. Here the yield was 66 bushels an acre, the best corn ever produced on the place. Contoured Atlas sorgho in an adjacent field was about as dense as a tropical jungle I once got painfully lost in, up on the watershed of the Chagres River, in Panama. The estimated yield of this jungle growth (I mean the sorgho) was 15 tons to the acre—another all-time record for the Watson farm.

There had been some rains to help—some of which had a punch. But the downpours had produced no visible erosion in the contoured fields. In a neighbor's field, however—same soil, same slope, just across the road—while the corn was not so bad—45 bushels—the downhill furrows revealed severe rill erosion between corn rows and heavy loss of rainfall. The soil and water loss in this off-contour field amounted to 21 bushels of corn per acre—or \$12 an acre. In both fields hybrid corn was grown.

On the Ginn place, near Bridgeport, Nebraska, an irrigation farm cooperating with the Morrill County Soil Conservation District, one gully, “deep enough to put a house in,” produced by improper use of irrigation water, had been filled and planted to a shelterbelt with five rows of trees. The severe erosion that had plagued much of this farm, as the result of long runs of water straight downhill, had been corrected by shortening the runs, rearranging

field boundaries, installing waterways stabilized by vegetation, and including grass-legume mixtures in the crop rotations.

Next day we came to the Thunder Basin land-use readjustment project in the drainage basin of Cheyenne River, north of Douglas, Wyoming. There was a generally good grass recovery on both sides of Big Thunder, as well as in the adjacent Inyan Kara grazing district and on various interspersed parcels of private land. Much of Wyoming was beautifully green. Heavier than average rainfall had helped. Not all the green was grass. Especially was this

Before readjustments were made through the land purchase program, the Spencers, according to Elmer's version, didn't even have enough elbow room and had no assurance of stability. Uninvited outsiders would push their sheep over on his range land, leased or owned, to eat his grass and drink his stock water. And pay nothing. He never could be sure, under such conditions, that his supply of range forage would carry his stock through a season. Leases were constantly being changed—"and you just couldn't plan anything with any certainty it would be carried out." "Now," he relates, "the Government's pur-



Dr. Bennett and Regional Conservator McClymonds observe one of the largest brome grass fields in the country—500 acres in one stretch. In 1941 the harvest of brome grass seed on this farm amounted to 100,000 pounds. Some 200 head of cattle were grazing on brome when this picture was taken.

true on land that had been plowed at one time for wheat. In such old fields at least part of the "blanket of verdure" was Russian thistle. But generally there was some grass, even in the old-field areas, and much good grass on land that never had been plowed. If you had seen this Plains country at the height of the drought in 1936, when everything was parched, you could readily condone such rhapsodic expressions as "a sea of grass stretching to far horizons."

Elmer Spencer ranches in the Thunder Basin grazing district. He, his wife, and young daughter live in an attractive house with good water and a splendid vegetable garden. The road that goes by this way is not paved; it could be said of it that it is "considerable long" via each end. Matter of fact, Spencer lives 60 miles from the nearest town, New Castle, 30 miles from a telephone, 7 miles from his R. F. D. box, 3½ miles from his nearest neighbor, 130 miles from good trout fishing over in the Black Hills. But there are antelope, deer, sage hens, and a vast abundance of elbow room.

chase of land has made it possible to set up the Thunder Basin Grazing District, and through the work and interest of the district and with developments by the Government, the range is being used according to carrying capacity, the forage is improving, and we finally have protection from trespass grazing and hazardous leases and permits."

Spencer runs 270 head of cattle on the 18 sections of land he owns, leases, or has permit to use.

Next stop was at Walter Peterson's place. Walter was in high humor. We were intending only to meet him, get a drink of water, pass the time of day, and move on; we were already behind schedule. But that didn't suit Walter at all. So during the next two hours we inspected his crested wheatgrass, his contoured corn, his stock ponds, his bins of grain and grass seed, and other things.

His 23 acres of crested wheatgrass had produced 940 bushels of seed. One of his stables was filled with the seed. "And I filled up all my metal bins with



Dr. Bennett talks subsurface tillage with a group of farmers at a Conservation Field Day on the Glasgow farm.

wheat and oats and then when the wife was off guard, I filled up the turkey house. I'll never hear the last of that.

"These conservation boys have saved me. I started contouring in the spring of 1936. I was pretty sick then. All the water that fell on my place was running off and I didn't have sense enough to know it. My two sons—young men they are getting to be, and fine boys—said, 'Dad, you are going deeper in debt every year with this dry farming; we don't want to quit you, but there isn't any future here.'

"Well, that hurt me. I had no answer then. I was going broke farming the old way. I was ready to try anything. And now I have the answer. Contouring has rescued me and my family; we are all happy now. But I still can't understand why I earlier missed the common sense thing to do—plowing, seeding, cultivating on the contour, using strips, building ponds for stock water, grazing the land by its carrying capacity, using the land according to its capabilities.

"I now have over 1,000 head of sheep. In 1934, I had 200 sheep and 15 head of cattle. Now I have 22 head of cattle, 900 ewes, and 500 lambs. Before, I was running sheep all across my range to a waterhole. Now I have several waterholes, located so as to use the range to best advantage. With this improved

system of running sheep there's better feed on the range and not so much traveling for the animals to get it. Last year I got half a pound more wool per animal than with the old system of grazing, and this year a pound more. Last year the lambs weighed 4 pounds more than with the old system, and this year 8 pounds more.

"I am getting 4 to 6 bushels of grain more per acre than before. That means \$3.50 more an acre, or better. My wheat on the contour will run up to 20 to 25 bushels an acre with a good season like this year; but the old way I got only about 15 bushels at the best."

We finally got back to the road, and we were late getting to bed that night.

Next day we moved on to Devil's Basin Grazing District, up north of Roundup, Montana, on the watershed of the Musselwhite. On one farm they were threshing crested wheatgrass from a 180-acre seeding and getting 70 pounds of seed per acre. This section was hit hard by drought and wind erosion in 1936, and before that the owner of the ranch was on relief, along with some of the neighboring ranchers. Under the land purchase and reorganization program ranching has been combined with farming on this tract—grass farming. The seed was bringing 12 cents a pound and the livestock looked powerfully good in the light of prevailing prices for beef.

Moreover, the crested wheatgrass straw was worth at least \$1 a ton, and even more, for feed. Besides that, the 180-acre grass field still had a lot of stubble-grazing in it.

We ate supper at the N-Bar Ranch. The kind of supper that makes you hungry whenever you think of it.

The N-Bar Ranch, cooperating in the conservation program of the Flat Willow Grazing District, runs 500 cattle and about 9,000 sheep on 50,000 acres. (It was near ranch headquarters of this outfit that we passed close to a herd of eight antelope and two coveys of sage hens. There were 18 birds in one covey.)

Later that evening, back at Roundup, a hint of autumn moved in from Canada. We were enjoying the luxury of a merrily blazing log fire when the word "cutthroat" somehow slipped into the conversation. It immediately turned the talk in the direction of fishing and fishing places. Discussion went on and on, but finally boiled down to genuine substance.

Accordingly, next day at noon we set out for Jackson Lake, in the Jackson Hole country over in the Tetons. We were taking leave and retreating to the wilds, remote from all sight and thought of soil erosion of any kind whatsoever.

August had just turned the corner into September. Even so, we ran into a driving snowstorm that continued for an hour. With that sort of weather practically in summertime, I was wondering why in the

early days the boys hadn't turned back in the first place when they got that far out on the Oregon Trail. A natural reflection, perhaps, for a Carolinian.

But soon everything straightened out. The road map showed that we were about two miles above sea level, in the Shoshone National Forest. This, the map indicated, was the first of the national forests, established by President Benjamin Harrison, March 30, 1891.

Skirting Yellowstone Lake we looked and listened for trumpeter swans. It was reported that 208 of these birds, which a few years ago came precariously near extinction, had been counted in the Yellowstone.

Next morning we went out on Jackson Lake at an early hour. The fishing was good, cutthroats and mackinaws were striking with thrilling frequency. At first I had some difficulty getting my fish reeled in, but soon got the hang of things and the fish too.

The Tetons were magnificent, even though the higher peaks were cloud-covered most of the first day. We were enjoying the grandeur and majesty of this alluring part of the world, and the solitude and complete isolation from daily routine. Our boat put-putted around a point and beyond the point—what do you suppose we saw?

No, it wasn't a bear, it wasn't a moose, or an elk. It was, believe it or not, a detail of CCC boys working on an erosion job!

(Continued on p. 137)

Farm pond in Turkey Creek Soil Conservation District, well vegetated with cattails, sedges, slough grass and other native grasses. Trees and shrubs have been planted, and pond fenced to exclude livestock. An ideal wildlife refuge. Water is piped from pond to tank 200 feet below for livestock. The dam provides water for 70 acres of pasture. Drainage area consists of 65 acres under intense erosion control practices such as terracing, grassed waterways, contour farming, residue management, and crop rotations.



CONSERVATION GOES ON THE AIR

By F. A. RANKIN ¹

THIS LAND WE DEFEND! On land, on sea, in the air . . . we Americans are determined to defend our way of life. We defend freedom . . . freedom of speech and religion, freedom from want and fear. We defend our homes, our schools, our churches . . . our fields and our forests . . . and our soil. We will defend our land against invasion—and we are defending our land against an enemy within our borders—soil waste.

Theme music swells to a momentary crescendo, then fades . . .

The United States Department of Agriculture presents another in the series **THIS LAND WE DEFEND**.

Over eight hundred radio stations in the United States daily employ some millions of watts of electrical energy to send out over the air waves and into the 50 million radio receiving sets the music, drama, and news to entertain and inform the American people. By the time the 1942 plowing season gets under way over half of these stations will have told the story of soil conservation in a new tone of voice, and over 10 million people, from coast to coast, will have heard at least the opening spiel of **THIS LAND WE DEFEND**.

The stations that broadcast the 10 dramatic shows composing the transcribed series, **THIS LAND WE DEFEND**, form a potent artery in the system which undoubtedly is one of the most powerful media of information in existence today.

With almost every brand of "drama"—from soap serials to Shakespeare—riding the ether waves week in and week out, it might appear presumptuous that the Soil Conservation Service should attempt to use the dramatic technique to tell its story. Soil conservation might be considered a dry subject. To some people soil conservation smacks of run-off plots, detention dams and diversion ditches . . . erosion conjures up fantastic visions of canyons and gorges, great river deltas, ghost towns . . . the erosion story is too dramatic, it cannot be dramatized convincingly!

Then why did the Soil Conservation Service go in for dramatizing the soil?

There are two reasons: The American people like drama; and soil conservation is a dramatic story.

That the average American listens to radio drama is evidenced by the fact that the average network station carries a dozen dramatic shows a day. Most of these are 15-minute serials. The radio stage, created by multiple imaginations, has at its command limitless settings where characters and sounds combine to portray the elements in every walk of life and thought. A dramatization is usually a re-creation of a case history. If anything that relates to people is dramatizable, then the story of soil conservation is well suited to dramatization, although six months ago there was some conjecture as to how it would lend itself appropriately to the dramatic technique.

We have a story to tell, a story that gains in significance as the holocaust of war spreads over the earth. We could not tell the whole story, but we could portray the highlights of the erosion problem and the efforts of a democratic people to solve it.

Failing to get the scripts produced as "live" shows, we chose the next best thing—to produce transcriptions. It was an experiment about which we felt some misgivings. We did not know whether we could avoid the pitfalls of under-dramatization and over-dramatization; and once we got under way, we had no assurance that the stations would use this type of transcription.

After the test pressings had been received, we auditioned the shows. Up to this point our chief concern had been production. We had developed no definite plans for distribution, but at the first audition we found at least a partial answer to our problem. Members of the Federal Radio Education Committee attended the audition and immediately asked for platters to distribute to some 2,700 schools throughout the country, schools having play-back systems. An important audience of two million boys and girls had been assured, but we still had to reach the vast adult audience in front of the receiving sets.

Thus it was that, with platters in hand, information men in each of the ten regions set out like traveling salesmen to peddle the shows to leading radio stations in the country. The transcriptions were offered first to the 50,000-watt stations, then to smaller stations. By October 15, the shows had been scheduled on fifty important stations, seventeen of which were of 50,000-watt power. As platters were returned from the first stations receiving them, they were offered to other stations, and so on until they no longer were

¹ Division of Information, Soil Conservation Service, Washington, D. C.

usable. We are estimating that before the platters have run their course at least 400 stations will have broadcast **THIS LAND WE DEFEND**.

We have estimated also that some 10 million people will have heard at least the 75-word opening spiel, which is the same for each of the ten shows. This is how we arrived at this estimate: There are twenty 50,000-watt stations which have broadcast the series. An average of 100,000 listeners for each 50,000-watt station, with 10,000 new listeners each week, adds up to 190,000 listeners, or 3,800,000 listeners in the 50,000-watt areas. (Most 50,000-watt stations have a potential audience of millions.) Two million school children who will hear the shows bring the total to 5,800,000, while the smaller stations—25,000-watt, 10,000-watt, 5,000-watt and smaller—will reach an additional 4 million listeners.

The theme of **THIS LAND WE DEFEND** is defense against "an enemy within our borders"—erosion. The purpose is to point out in these days of hectic national defense effort the need for constant vigilance in the conservation of our basic natural resources. The series emphasizes the fact that our soil must be conserved in order that the democratic way of life can be maintained, and the emphasis is placed upon conservation in the democratic way.

The entire series was produced under the direction of Shannon Allen, in the studios of the U. S. Department of the Interior. Actors, musicians, sound-effects men and other technicians who worked on the shows are professionals.

The titles to the shows might cause wonder as to where soil conservation comes into the picture—Mormons, Pennsylvania Dutch, Snow Surveys, Beaver, and so on. It looks more like the "Cavalcade of America" than a series of soil conservation shows. These synopses of the scripts make clear the relationship:

The Beaver

This is the story of America's number one conservationist—the "original upstream engineer." The beaver is an agronomist, forester, dam builder, irrigator, canal builder, and lumberjack. When the first settlement was made in America there were more beavers than there now are people in this country. The beaver was a valuable animal. Man went in search of the beaver, up every little stream. He hunted the beaver in every part of the country. By 1900 the beaver was almost extinct. Then man began to realize that a valuable resource was about to vanish. Today we are calling on the beaver to help

us with our conservation work. We are using beaver to do flood control work, erosion control work, to restore meadows and to perform other conservation chores.

Dust Storms

Man has misused the Great Plains. Man laid the foundation of the "Dust Bowl." Man's unwise treatment of the land led to unrestricted wind erosion. Man tried to farm land that should never have been farmed . . . tried to farm the way it was done along the eastern seaboard, in small sections. Too much farming, too many people, too many cattle, years of drought, and then . . . DUST. This is the story of man's mishandling of the Great Plains and how we are now going about the job of stabilizing the Dust Bowl.

Snow Surveys

This is the true story of those hardy men who brave the wintry perils of the rugged mountain ranges of the West to survey the snow fields. The snow pack must be measured because the plans of thousands of people in the arid and semiarid West depend upon the mantle of snow and the water in it. Farmers, ranchers, irrigators, power companies, bankers and others, depend on the snow in the high Sierras, the Rockies, the Siskiyous, and the Cascades. The story takes place on the high mountain snow courses where the snow survey party is measuring the "snow crop."

Pennsylvania Dutch

For over 200 years the "plain people" of Pennsylvania have ranked among the finest farmers in the world. This is the story of the Mennonites, Amish, Dunkards, Brethren, and other plain people and their land. The "plain people" have lived close to the soil—and prospered for it. Even in rich Pennsylvania, much of the land has been overworked. Soil erosion has begun to show up on the rolling lands of the "plain people." Erosion has begun to sap the vitality from the soil. Conservative, slow-to-change, yet devoted to the soil, the "plain people" of Pennsylvania have awakened to the danger of soil erosion and are successfully defending their land by terraces, contour cultivation, strip cropping, and other erosion control practices.

The Mormons

Brigham Young led the Mormons west through more than a thousand miles of hardship to establish an ecclesiastical and economic empire in mountainous Utah. The Mormons made the desert flourish. They

built one of the great cities of the world. Where once there was desert now there are trees and flowers, fields of green vegetables and other crops. Where there were wolves and coyotes now there are green pastures and flocks of cattle and sheep. Where there was sagebrush there are fruit trees. Where there were alkali sink holes there are fountains. The Mormons developed one of the finest irrigation systems in the world. They work diligently to conserve their soil and water resources.

The Saga of the Forest

Three hundred years ago there were over 800,000,000 acres of trees in America. This is the story of man's conquest of the forest. In "winning" the continent, man lost much. Millions of acres were shorn of tree and grass. Soil began to move, and with it the vitality of man and the land. But in recent years we have begun to rebuild the soil. We are using billions of trees for erosion-scarred hillsides. Billions of trees to clothe the soil, to stand guard against erosion, floods, and silt.

America's Vanishing Soils

The soils of the earth are like the races of man. There are the black soils, the red soils, the sands, and the yellow clays. Soils vary in color and age and in many other ways, just as the races of man vary. Some are old, some young; some are sturdy and strong; some are thin and anemic. This is a story of how soils are created; how man has mistreated them; how we are today mending our soils.

CONSERVATION ALONG THE OREGON TRAIL

(Continued from p. 134)

Well, well, of all things, how come any erosion way over here in this sort of a situation anyway—was the first query.

It was the same old story. Man had mixed up with Nature, upset the natural balance and, in this case, started shore erosion along the westerly facing banks of both the mainland and the islands. The water level had been raised by installation of a dam by irrigation farmers, and at high water the waves were lashing at the shoreline to reestablish equilibrium farther back from the high-water line. Some islands have been stripped of trees since the construction of the dam and severe toll is being taken of others.

This situation is very much the same as that which developed on Lake George, New York, after the rise in lake level produced by the installation of a dam.

Soil Conservation Comes of Age

As long as there was plenty of new land to exploit, we paid little attention to erosion. But when new lands no longer lay "just ahead," we were forced to double back on what we had. In recent years men have begun to look closely at their soil, have begun to see that soils are not permanent, that they must be protected. This script traces the soil conservation movement from the days of Washington, Jefferson, and Henry, to the present conservation movement as carried out by farmer-organized soil conservation districts.

Democracy at Work on the Land

This is a dramatization of a soil conservation districts meeting. The board of supervisors discuss various erosion problems in the district—farm planning, terracing, flood control work, reforestation, labor supply, and the like.

Floods

The Ohio flood of 1937 swept away life and property, destroyed homes and hopes, left in its wake a sterile mass of muck and debris. Floods are not new in America. They are as old as the Nation. On the average, over 100 people lose their lives annually in floods—and more than 100 million dollars worth of property is destroyed. This is a story of what American farmers are doing to help reduce the flood damage through the use of soil conservation practices.

It is not so easy nowadays to get away from man-induced erosion. About the only places left where you don't run into it are the low flats along the Atlantic Gulf Coast and the heavily grassed or forested areas.

But the United States now has its eye on the erosion problem whether encountered along the Oregon Trail, way down in Jackson Hole, or in the cotton fields of Dixie.

That part of the trip west of the Rockies—well, that will have to wait.

The cultivated small fruits, such as blackberries, raspberries, currants, gooseberries and grapes, can be used in single row plantings as contour guide lines and to supply an abundance of table food often lacking in the farm family diet.



PRINCIPLES AFFECTING THE CONTROL OF EROSION IN ROAD CUTS AND ROADSIDE DITCHES

By J. W. JOHNSON ¹ and HUGH A. BROWN ²

COMMON observation has shown that unprotected road cuts and roadside ditches constitute one of the more frequent causes of gully development. Recent data indicate that gullies paralleling roads or receiving drainage from them not only cause much damage to the land, but serve as principal sources of the sediment impairing downstream reservoirs, stream-channel capacities, and agricultural bottomland soils.

A recent survey of the watershed of Lake Issaqueena, developed on Six Mile Creek near Clemson, S. C., in 1938 by the Land Utilization Division for recreational purposes, showed that control of erosion along roads was one of the principal problems to be solved in protecting this reservoir against an excessive rate of silting. A brief study of the character of erosion and transportation of erosional debris to the reservoir led to the conclusions expressed in this article on the principles affecting the control of roadside gully erosion.

Erosion of road cuts, ditches, or even the ordinary gully, generally occurs in two distinct zones, (1) the side slopes and (2) the channel bed. Where steep and barren side slopes are exposed to the direct impact of rain, a considerable quantity of sediment is dislodged and then carried into the bed of the ditch by direct flow or slumping. Once the run-off water is concentrated in the channel, material is transported either by

rolling along the bottom or in suspension, depending on the water discharge, the bed slope, and the relative size of the sediment particles. The finer material dislodged from the steep side slopes, mainly by the impact of raindrops (but also by freezing and thawing), moves out of the ditch and either deposits on bordering flatter land or moves on into the larger streams. Usually the bulk of the fine material is transported to the point of deposition by run-off from the same rainstorm that dislodged the material from its original location. On the other hand, the coarser material that ordinarily forms the channel bed is moved downstream at a relatively slow rate, and several storms may be required to move a particular particle out of a ditch.

Erosion plot studies have shown that the intensity of rainfall is more important than the amount of rainfall in determining the volume of erosion losses from surface slopes. In the initial stages of a rain, the impact of the raindrops upon the ground appears to be the most important factor governing the concentration of solid matter in the run-off water. The amount of soil lost from a plot varies approximately with the first power of the slope and the square of the rainfall intensity. To guard against excessive soil loss from roadside ditches and road cuts, it is obviously most important to protect the side slopes from the direct impact of rains. Experience has shown that sodding the slopes or planting kudzu or similar erosion-

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Sloping and planting produced this remarkable transformation of a roadside bank which had been badly eroded by drainage from farm land.

control plants along the crest of cuts, gullies, and ditches generally affords adequate protection. This may be noted in the accompanying photographs.

Unprotected side slopes of road cuts, ditches, and most gullies not only contribute a large amount of finer material which commonly enters the natural stream systems and is transported to downstream reservoirs or other places of deposition, but also contribute much of the coarse material that forms the movable bed in the ditch.

The coarser material making up the bed of a ditch forms an erosion pavement that changes in configuration and thickness only over a period of time. This coarse material, which enters the ditch either from the side slopes or from other sources such as terrace outlets or connecting road ditches, tends to stabilize the ditch bed and to prevent or reduce downcutting. If the slope of the ditch is steep, however, and the volume and duration of flows, because of the size of the drainage area, are great, then the rate of transportation of the bed material will exceed the rate at which the supply of material enters the ditch; then retrogression or downcutting will occur, and will continue until a resistant material is reached, or until the bed slope is so flattened that the velocity of flow decreases and a state of equilibrium with the load is reached.

Just as data from experimental plots indicate the nature of soil losses from ditch side slopes, so do laboratory investigations on the transportation of bed load give information on the movement of the loose granular material that forms the ditch bed. These investigations show that the rate of transportation of such material varies principally with the bed slope and the depth of flow. By reducing the magnitude of these factors, it is practicable to reduce to a minimum the

amount of material moved out of a particular ditch. The effective slope of a ditch can be flattened by check dams, and the depth of flow can be reduced either by diverting a portion of the flow or by widening the bottom width. Downcutting will occur only when the bed slope is so great that the amount of material transported out of the lower end of the ditch exceeds the supply contributed by the side slopes and tributary ditches. Control methods that induce deposition in a ditch are generally preferable to those that permit cutting, because objectionable deposits can be easily and inexpensively removed by road scrapers and other equipment, while downcutting, if in advanced stages, may be both difficult and expensive to remedy.

In some instances the supply of coarse material entering a ditch may be reduced or eliminated by protecting the side slopes or by diverting to other channels that material coming from terrace outlets or other ditches. If the supply of coarse material is reduced or eliminated and water is still allowed to enter the ditch in appreciable quantities, the coarse material existing in the ditch at the time of interception continues to move downstream, with the result that the bed is scoured or lowered until a relatively stable slope is reached. If all material is transported out of the ditch, erosion into the underlying subsoil horizons will become active and the effects damaging. Although heavy and stiff subsoils usually are relatively resistant to erosion by water flowing over their surface, and the sediment load from this source in a single storm may be small compared to the load contributed by rain impact upon exposed side slopes, it is of particular importance especially in the southern Piedmont, that erosion be prevented from penetrating through the B horizon into the C horizon, because the

C horizon has, in general, little or no binding qualities and disintegrates rapidly under the action of flowing water.

The primary difference between flow over a sand bed and flow over a bed of stiff soil is that in a sand bed the sand particles move downstream at relatively slow rates, and other sand particles usually are entering the upper end of the channel to replace the material moved out from the lower end. With the more or less constant exchange of material throughout the length of the ditch the position of the bed remains relatively stable so long as there is no great change in outside conditions. In a channel with a bed of stiff subsoil, particles are more difficult to dislodge from the bed, but once dislodged, they are easily transported, and no similar material moving down from upstream sources is able to deposit and take their place. Downcutting and resulting bank cutting will therefore proceed unimpeded.

The logical and practical control of roadside ditches and road cuts for protection against undermining of roadways and adjacent fields and the elimination of these sources of sediment production lies (1) in the protection of steep exposed side slopes by a vegetal cover and (2) in the prevention of any disturbance of the erosion pavement of sand in the channel bed. Drop structures of various designs may be necessary

if the bed slope is relatively steep. Channel reshaping in some instances is effective in spreading water laterally and reducing its erosive action. It is undesirable to disturb the sand bed of a roadside ditch by using road scrapers and other equipment, unless certain factors such as road drainage improvement make it imperative to do so. Diverting water from a ditch at frequent intervals into vegetated channels, meadow strips, or heavily vegetated areas, such as a woods, not only serves to reduce the volume of flow which may otherwise become concentrated and cause excessive cutting in the lower reaches of the ditch, but the sediment is trapped and prevented from reaching the main stream.

The accompanying photographs illustrate typical examples of effective erosion-control methods. Of these, sloping and sodding are perhaps the most expensive methods, but the results are considered the most permanent and also present a pleasing appearance. An inexpensive method consists in the planting of kudzu which eventually spreads over even the steepest slopes and gives adequate protection. There are many control methods that can be used, but the important requirement in all such work is to recognize and respect the basic principles governing erosion in order to obtain the most effective control at the least cost.

A PASTURE THAT DOES NOT TAKE "ANNUAL LEAVE"

By GLENNON LOYD ¹



Ed Jeché's Guernsey herd finds abundant succulent feed on this improved pasture in mid-August when most of the meadows in southern Minnesota have not a spear of green in them.

ED G. JECHE, a quiet pipe-smoking farmer living 4 miles east of Spring Valley, Minn., does not join in the chorus when his neighbors lament meager milk production in the latter part of July and in

August. He merely smiles and thinks of this 25-acre pasture that doesn't go on "annual leave" and cause his Guernsey herd to let him down. But more of this pasture later . . .

In late summer little rain falls in the southern Minnesota dairy country where Jeché lives, and a

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Ed. Jeche, left, and Jacob H. Janzen, project conservationist, in the 25-acre pasture that provides feed for Jeche's Guernsey herd six months a year. Here graze 18 cows and 16 heifers and calves. The wire cage in the foreground is used to protect a small area from grazing so that estimates may be made of the field's yield in terms of hay.

brilliant sun frequently drives temperatures to the 100° mark. Bluegrass takes a well-earned summer nap, and most of the meadows sprout no more spears of succulent grass than a billiard ball does hair.

This is always a time of fretting for the thrifty farmers of southern Minnesota who do not like to see their cream checks dwindle while waiting for the reviving fall rains to repaint the landscape in a nice shade of green.

Some farmers attribute the decreased milk flow solely to "flies and this blamed hot weather." Others, more discerning, observe that their herds find in the pastures little more than "standing room only." Those inclined to be humorous in spite of adverse conditions refer to their meadows at that time of year as "exercise pens."

Jeche, whose blue-gray eyes reflect his earnestness, for some time has been numbered among those farmers concerned about late summer meadows as well as about soil erosion that was thinning crop yields year by year.

Thus it was that in 1937 this farmer welcomed the opportunity to become a cooperator in the Deer-Bear

Creek soil conservation demonstration project that had its headquarters at Spring Valley.

He and the project technicians drew up for his rolling 200-acre place a farm-conservation plan that met not only the erosion problem but also that of adequate summer pasture for his expanding Guernsey herd.

This 63-year-old farmer was as deeply concerned about the soil that had washed away from the land as he was with the lack of pasture. Jeche's father homesteaded the place in 1859 and Jeche was born there in 1878. He did not have to be told that more than half of the topsoil had washed away from most of his hillsides—and hillsides are all you can find on his place. Gullies had begun to sprout up like weeds.

Each November, Jeche observed that he must travel up and down more and more rows before putting the sideboards on his husking wagon. Each August the threshing machine told him that his yields of oats, barley, and wheat were slipping.

It had become harder and harder to get a catch of red clover. Bluegrass alone had failed, and timothy fields with a few sprigs of clover looked pale and thin.

Today the situation is greatly changed. All of Jeche's tilled land is strip cropped on the contour. His 5-year agreement with the Service expires next spring but he says he will never go back to farming parallel with the fence lines—"not after the experience we've had with this."

"I didn't think we would like the strip-cropping," he said, "But we do like it now, and we know it does the land a lot of good. We don't have the washing we had when we worked the land up and down hill."

But this quiet farmer's enthusiasm is most noticeable when he talks up his 25-acre pasture that provides feed aplenty from mid-May until it is blanketed with snow for the winter along in November. He has 18 cows and 16 head of heifers and calves on the pasture for the 6-month period. When they are on the pasture, he does not barn-feed the cows—and he told us that when he finally switches them over to winter feed, he does not experience a jump in butterfat production.

His records disclose that his butterfat production has been on the increase since the pasture began yielding in 1939. His 1938 butterfat production averaged 257 pounds per cow, while in 1940 the average was up to 292 pounds.

Of course, Jeche does not attribute the increasing production to the pasture alone. He does point out quickly, however, that it provides feed for the herd for half the year, and that there is no labor involved for seeding, cultivating, or harvesting crops.

(Continued on p. 145)

Check-Up On Perennial Forage Plants

By R. Y. BAILEY ¹

AROUND the last of August, I spent 3 days inspecting the Dadeville, Ala., Demonstration Project Area, with the definite purpose of determining what use farmers were making of the perennial forage crops that were planted while the demonstration project was being developed. Were farmers mowing

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kudzu and sericea for hay? Were they overgrazing these crops? Were they plowing them up? Were they planting any additional acreage? These were questions that seemed particularly important in connection with this demonstration area where the program was to such a large extent built around perennials.

First, I found that the sericea lespedeza has made



Cotton and corn were grown on this steep slope in the coastal plain until the sandy topsoil and much of the subsoil were lost. Kudzu was planted in the spring of 1937 and this picture was made September 8 the same year.

The same slope August 1, 1939, when the kudzu was in the third growing season.



vigorous growth, but is not being utilized as fully as it should be. I saw several farms where sericea was being mowed for hay, but on many others it had not been cut. Farmers who are harvesting sericea hay are well pleased with yields and quality of hay, and it appears that failure to utilize it by others has been due largely to the fact that most farmers in the area do not own mowing machines. It is frequently impossible for them to rent or borrow mowing machines at the time sericea is ready to harvest. Also, the first cutting of sericea hay is ready to harvest at a time when other spring work is pressing. By the time farmers are ready to mow it, the plants are too far advanced for good hay.

In a few places sericea had been plowed up and the land returned to row crops. In all such cases, the crop had not been utilized for hay and, consequently, its value as a forage crop was not appreciated.

As for seed from this perennial, I saw indications that there will be more sericea seed harvested than in any previous year. This was encouraging, as the cash income from this seed may stimulate interest in the plant. It was encouraging also to see steady increase in the acreage of sericea on farms where it was harvested for hay. Much of the seed harvested this fall will be used to plant additional acreage on farms where it has been utilized for hay.

Kudzu has made striking progress during the past 4 or 5 years. I traveled practically all roads in the project area and from almost every hilltop I could see one or more fields of kudzu. Many of these fields had shown little sign of kudzu above the weeds and other vegetation until this year, when it finally outgrew the weeds and produced a dense growth of rich green forage. The abundant rainfall during the summer of 1941 was an important factor in this development. Applications of phosphate made in the spring of 1941 also contributed to the growth of kudzu. The use of phosphate has been greatly increased because of the demand for crowns. A large number of farmers applied phosphate and disked their kudzu in the spring of 1941, in order to sell crowns next year.

The most striking phase of the development of perennial forage crops at Dadeville is the complete transformation of those rough gullied fields the farmers were willing to have planted to kudzu in 1935 and 1936, only because they had no hope of ever using this land for any other purpose. I visited one 39-acre field where a CCC crew spent several weeks in the construction of various types of dams for gully control in the summer and fall of 1934. This field was planted to kudzu in the spring of 1935 and was given little

treatment until the spring of 1941, when phosphate was applied and the entire area was disked. The steep slopes of this field, once marked by numerous gullies, are now completely covered by a dense growth of kudzu. Thus this field, that at one time was considered worthless as a result of continued cultivation in row crops, has been restored through better land use to a high state of productivity. If the present ground cover is properly maintained and wisely used, this field will contribute in a very real sense to a permanent agriculture.

Farmers are utilizing kudzu for hay and for temporary grazing. Every area that has made sufficient growth has been either mowed for hay or grazed. In several instances the stands have been injured by mowing too frequently, while in others overgrazing has resulted in complete destruction of the stands. Most of the overgrazing occurred where tenants fenced small areas and practiced continuous close grazing, although in some cases ownership of land has changed and new owners have fenced portions of the kudzu fields into permanent pastures, with the result that the stands are seriously overgrazed. In general, however, injury by mowing or grazing is less than might have been expected in an area where such a large proportion of the land is farmed by tenants with very little guidance from the absentee owners.

During the inspection tour I saw a few fields of kudzu where farmers had plowed and returned the land to row crops, almost invariably before a complete stand was established. In some instances farmers became impatient with the delay in getting a stand; in others they were afraid kudzu might become a troublesome pest.

After a careful study of the perennial forage plantings in the Dadeville area, I concluded that not more than 5 percent of the kudzu and sericea had been plowed up or destroyed by grazing. This is a remarkably low loss in acreage when it is considered that less than 1 percent of the farmers in the area knew anything about the value of either crop when it was planted on their land, and that much of the land was operated by tenants who knew nothing of the value of either crop. They were interested chiefly in the production of cotton and corn, and under such conditions we might have expected that a much larger acreage of the perennials would have been destroyed.

The new plantings of kudzu made in 1940 and 1941 far outweigh the acreage destroyed by plowing or grazing. Although new plantings have not been



Lespedeza growing on a steep slope in the Piedmont near Gainesville, Ga. The sericea is being cut with a scythe and fed green to work stock, cows, and hogs.

recorded on a project area basis, available records for Tallapoosa and Chambers Counties, where the project area is located, indicate that approximately 2,000 acres were planted to kudzu in the old demonstration area in 1940 and 1941. These new plantings were rather evenly distributed over the area, and I observed many of them during the three days of inspection. In general, the new plantings are on much better land than was devoted to kudzu in the earlier years, and they are being given better cultivation than any of the earlier plantings.

As evidence that the perennial plantings at Dadeville have developed into something of value, a famous canned-milk company, after surveying several counties, decided to locate one of their plants in Dadeville. I was told that representatives of this company stated that the feed production program that had been developed through use of perennials in this area was one of the most significant they had seen anywhere in the country. It appears that the perennial forage being produced on land which farmers had abandoned may be the basis on which a change will be made from a row-crop agriculture to a better balanced type of farming including livestock.

Although time did not permit me to make a careful study of every phase of the program at Dadeville, it was pleasing to note that in several instances farmers had plowed terraces for maintenance during the 1941 summer. This was noticeable on land that had been in small grain in the spring.

Woodland plantings have made striking progress. The growth of pine has been highly satisfactory.

Black locust, on the other hand, does not seem to be making as rapid growth as it made during the first few years.

I found that encouraging progress has been made in pasture development during the past 3 years. Excellent pastures are being developed where lowland areas are brushed, limed, fertilized, and seeded.

This report would be incomplete if I did not call attention to a few of the major mistakes that were made at Dadeville. Chief among these was our failure to include sufficient annual lespedeza in the cropping system—this important phase of the vegetative program was not given sufficient attention. Fortunately, this early mistake is being corrected. An increasing number of farmers are growing annual lespedeza on their cropland and it appears that within a few years this important plant will come into general use in the area. The livestock program, in connection with the milk plant, should stimulate interest in annual lespedeza, which will be needed to round out the feed production program that is necessary in a dairy enterprise.

Crotalaria was not given sufficient attention in this area. Although a considerable acreage was planted to crotalaria, we did not use it as extensively as we should. I saw many fields where fair stands of volunteer crotalaria plants were growing as a direct result of seedings made in 1935 and 1936. I believe that crotalaria will come into much more general use, particularly as a cover crop following small grain.

Another mistake in this area was our failure to make more careful selection of land for perennial forage

crops. In the early years at Dadeville, we had very little conception of the principles of land use. Most of our perennials were planted in the effort to get acreage. We did not give sufficient attention to the selection of sites according to the capabilities of the land. The lessons learned at Dadeville during these early years have been reflected in the improved land use in evidence at later projects, CCC camps, and soil conservation districts in Alabama and other parts of the Southeastern region. Largely as a result of what we learned at Dadeville, a large proportion of the perennials that were planted after 1937 were in strips on critical slopes and at other places in fields where they would be most effective for erosion control and soil conservation.

Further improvements can be made as the old project agreements are converted to farm conservation plans with the soil conservation district. It is particularly important that additional acreage of perennials be established so as to avoid destruction of stands through excessive grazing and mowing. It is essential, also, that we make a systematic effort to bring annual lespedeza into the cropping systems for the production of additional forage and grazing and for soil improve-

ment. I believe that an increased interest in farm dairying will develop after the milk plant is established, and that farmers will gradually shift from a row crop to a more protective type of farming.

My observations during the 3 days I spent in making this study lead me to believe that we must make a drastic increase in the acreage of close-growing crops, and a corresponding decrease in the acreage of clean-tilled row crops, before the agriculture in this area can be placed on a safe basis. It is my opinion, after this study, that eventually the acreage of row crops must be reduced by at least 50 percent, if these steep lands are to be used permanently.

On the afternoon of the third day of this study, I was so fortunate as to have Representative Joe Starnes of the Fifth Alabama District with me in the field for a short tour. Mr. Starnes had visited this area when we were starting the demonstration project in the fall of 1934 and he was in a position to appreciate the development of the program during the past 7 years. He was most enthusiastic about improvements through the use of perennial vegetation, and he also expressed himself as being highly pleased with the results obtained from the funds expended at Dadeville.

DOES NOT TAKE "ANNUAL LEAVE"

(Continued from p. 141)

The threshing rig was in the barnlot the day we stopped to see Jeche—"Jake" Janzen, the Spring Valley project conservationist, was with me. But work or no work, Jeche was not too busy to steal away for a short while to tell us about his pasture. While I visited with him, Janzen tossed a load of bundles into the separator.

The Guernseys were grazing contentedly in the pasture and, judging from its appearance, that pasture could have supported the two neighbors' herds for quite a while, along with the Guernseys. The neighbors had just as many acres of pasture per cow, but their grass was "toast" brown.

One must not get the impression that the pasture is the most fertile piece of land on this farm. One part of the farm was so steep and undulating, and so shot full of gullies, that it did not lend itself to contour cultivation—that part is the pasture today. Most of it lies on a 12-percent slope.

In 1938 it was seeded to a new type of pasture mixture with a nurse crop of barley. The mixture was comprised of sweetclover, alfalfa, brome, and timothy. About 5 pounds of each were seeded to the acre.

Yield data taken from the pasture, in cooperation

with the agronomy division of the University of Minnesota at St. Paul, tell why Jeche's butterfat production does not slump in the summer. On the basis of 15-percent moisture, the pasture produced the equivalent of 3.66 tons of hay per acre in 1939, 3 tons in 1940 and an estimated 3.19 tons in 1941.

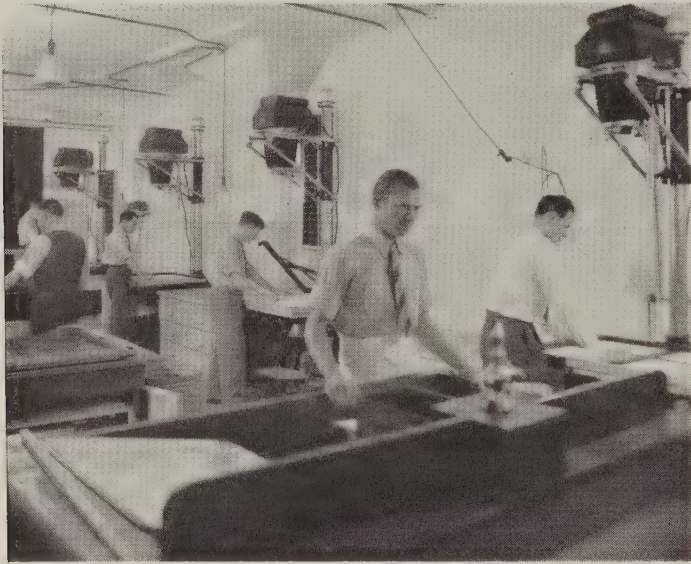
With an electric fence that parallels the main waterway of the farm, Jeche has divided the pasture into two almost equal fields. This makes it possible to manage the sweetclover so that some goes to seed in one of the fields every year. Otherwise, he switches the stock from one side to the other so as to keep both parts properly grazed.

This year the pasture did its intended job just as well as it did last year and the year before, and there is no prospect that it will slow up. As a backstop, however, Jeche depends on the three fields adjoining the pasture. Since two of them each year are in hay as a part of the crop rotation for the farm, they are ready for supplemental pasture duty, if needed.

How valuable a good pasture can be in sudden emergency was demonstrated to Jeche on July 10, 1940, when he was completely "hailed out." His record book shows his yields for corn and small grains as all zeros. The pasture, beaten into the ground by the hail that denuded most other vegetation, recovered within a week.

PHOTOGRAPHIC METHOD OF PREPARING FARMER-DISTRICT AGREEMENT MAPS

By W. F. BEAMON and M. S. KENNEDY ¹



Working by the new method.—Typical enlarging and developing room.

THE Soil Conservation Service has established photographic service at each of the regional offices. The units are attached to the Regional Cartographic Divisions. They are equipped to make cartographic reproductions as needed in our soil conservation program, but their main responsibility is to reproduce photographic maps for use in the Farmer-District Cooperative Agreements.

When plans for the district program were concluded, a meeting was held in the Washington office to discuss the proposed organization and a method of handling the work. During this meeting a quota was established for the number of Farmer-District Agreements that the field men would be expected to sign up each month.

On the basis of this quota the staff of the Cartographic Division attempted to work out their plans so that they would have sufficient draftsmen available to draft the maps for the Farmer-District Agreements by the same method they had been using for the Farmer-Project Agreements.

It was immediately apparent, however, that to handle this number of drawings by the old method it would be necessary to add several hundred draftsmen to the force. Furthermore, upon investigation it was found that such a large number of draftsmen, with the necessary qualifications for this type of work,



Working by the old method.—Typical drafting room.

were not available. To secure enough men for this work it would be necessary to initiate a large training program; it would be expensive and it would delay the program. With these serious problems confronting them the staff members of the division decided to attempt to devise a new process by which the output of the force could be increased and the need for training such a large number of draftsmen could be eliminated.

Many suggestions were offered, but the final decision to try out a method whereby the farmer-agreement maps could be reproduced photographically came about as a result of the fact that the Department of Agriculture already had available aerial photographs for about 75 percent of the farm lands in the United States.

It was proposed that, first, the physical surveyor would make a land evaluation survey on aerial photographs, at a scale of 4 inches to 1 mile, in the same way as in the past. When a farm had been selected for planning the conservation-survey photograph of the individual farm would be enlarged by the photographic laboratory to the desired planning scale (usually 8 inches to 1 mile); and, at the same time, a plain aerial photograph on the same scale would be made for the planner to use as a base on which to plan the farm. The conservation-survey photograph was to be colored to show use capabilities and used as the planner's guide. After the farm was planned in

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pencil on the aerial photograph, the Cartographic Division was to ink in this plan, in a finished drafting style, and then the photographic laboratory would make the required number of copies of the land-use and use-capability maps for inclusion in the Farmer-District Agreements.

It was decided that, before adopting an idea so radically new, a complete test would be made to learn whether or not the photographic method was feasible and practical. In September 1938 this test was conducted in the Western Gulf Region of the Soil Conservation Service. This region was selected because of the farms ranging from small units, intensively farmed, to large range units. This region also had available all the necessary laboratory equipment for such a test. For the test, ten typical farms were chosen from various parts of the region, and completed agreement maps for them were reproduced by both processes, while very accurate time and cost records were kept for each step.

As a result of this test it was found that the cost of reproducing the Farmer-District Agreement maps by the photographic process was slightly less than by the drafting method. As the photographic process had just been started it was thought that these costs would be reduced further as the personnel became more proficient in the method. To date, although the cost varies slightly in the different regions, this original cost has been cut almost in half by streamlining the process and designing more efficient equipment.

The test brought out numerous advantages of the photographic process. The most important of them are enumerated below:

1. This additional work can be carried on with the present force of draftsmen and the addition of only a few photographers.
2. The farmer can understand a map drawn on the aerial photographic base more easily than a hand-drawn line or symbolized type of map.
3. The amount of drafting is greatly reduced when the work is performed on an aerial photographic base that already shows all of the physical features of the farm.
4. The aerial photograph makes an ideal base for the physical surveyor to use in determining his land use capabilities.
5. Coloring indicating these capabilities can be easily superimposed on the conservation survey copy without covering up the field work.
6. At group planning meetings it is possible to furnish each farmer with an aerial photograph of his

own farm on which all physical features are clear and understandable.

7. It greatly shortens the time needed to deliver the finished agreement maps to the planner.
8. Copies of the agreement maps can take greater reductions and still have the same degree of legibility.
9. The reduced size of the map makes possible a much better arrangement of the agreement.

After a report of the test was submitted to the Washington office it was decided that the photographic process would be adopted. On January 4, 1939, a Field Memorandum was issued authorizing the setting up of a laboratory for this work at each regional office and establishing a procedure for making Farmer-District Agreement maps by the photographic process.

Steps were taken immediately to determine the proper photographic and reproduction equipment needed to carry on the work. After thorough consideration of all types of photographic equipment on the market, and after a few pieces of new equipment had been designed especially for this work, photographic laboratories were set up at all of the regional offices.

These laboratories have been operating for the past several months and, although some of the regions still are not signing agreements to their full capacity, yet it is gratifying to know that during the past year they have turned out a large amount of work. The following tabular statement will give some idea of what this work involves:

Aerial Photographs

Negatives developed.....	146, 280
5'' x 7'' Photographs printed.....	5, 616
8'' x 10½'' Photographs printed.....	568, 944
16'' x 20'' Photographs printed.....	20, 340
20'' x 24'' Photographs printed.....	38, 472
Misc. add. sizes printed.....	69, 384

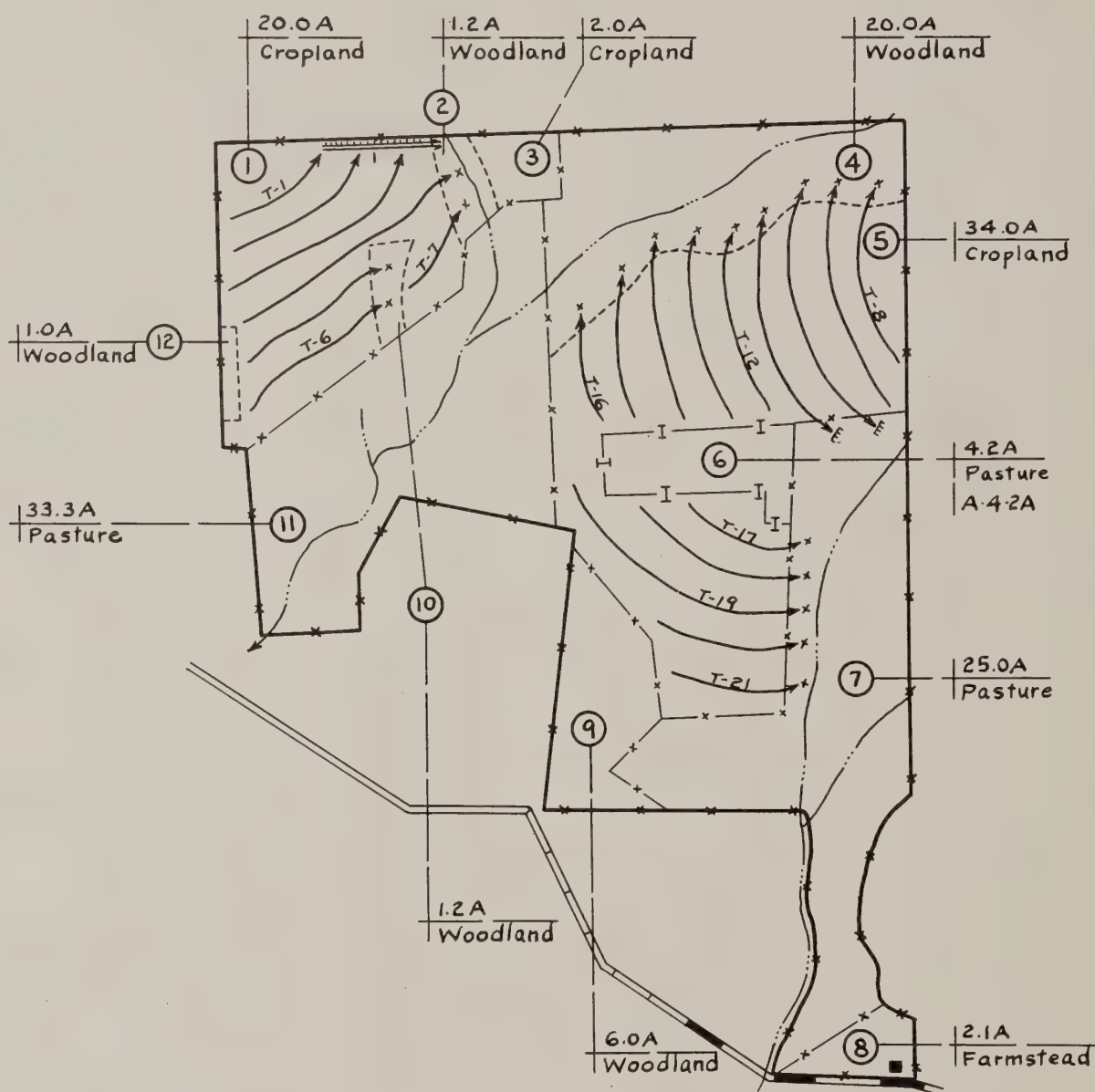
This work serviced approximately 60,000 farms throughout the entire United States.

General Visual Photographs

Negatives developed.....	36, 288
5'' x 7'' Photographs printed.....	172, 440
8'' x 10½'' Photographs printed.....	15, 444
11'' x 14'' Photographs printed.....	1, 884
16'' x 20'' Photographs printed.....	1, 236
20'' x 24'' Photographs printed.....	624
Misc. add. sizes printed.....	11, 520

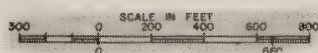
Although primarily these laboratories were set up to reproduce photographic agreement maps they were found to be extremely valuable for many other uses. For example, they produced last year approximately 1,345,957 square feet of Ozalid prints; 165,502 square feet of photostats; numerous trans-

(Continued on p. 149)

SAMPLE MAP

LAND USE MAP		PLANNED	TRACED	CHECKED	Sgnds
ILLINOIS BAYOU - ARK 108					
CONTRACT NO. 20 FARM CODE NO. 4-4-62					
SUBMITTED BY Henry Wilson					
OWNER James Johnson					
ADDRESS Stuttgart Ark					
OPERATOR Bill Jones					
ADDRESS Stuttgart Ark					
ACRES 150					
SCALE 1" = 660' LEGAL DESCRIPTION					
South 1/2 of West 1/2 Section 41					
H. & T. C. Block 14					
BY	DATE				
Brown	9-30-38				10-2-38

Typical land-use map made by the drafting method



LAND USE MAP	
Owner	Chas. G. Landowner
Address	Quailtrap, Tennessee
Plan No.	Tenn-112-77
Code No.	AEY-173-1

Typical land-use map made by the photographic process.

(Continued from p. 147.)

parencies, blueprints, vandykes, derma prints, and other types of reproductions that were necessary.

At the time these laboratories were set up very little thought was given to national defense. Recently however, information has been received from the War Department that, if emergency arise, these laboratories

will be called upon to do photographic work in connection with defense. Fortunately they are all thoroughly equipped and staffed with experienced men, and could, if necessary, exert their entire efforts to defense of the country. Already several of them are spending part of their time on work having to do with national defense.

A Double Check On Erosion

By M. E. MORTIMORE¹

ESTIMATES of the volume of soil losses as well as the degree of erosion are important in connection with planning conservation programs for flood control, and for protection of reservoirs, stream channels, etc., against damages by sedimentation. Volumetric estimates previously made from standard conservation surveys did not prove to be entirely satisfactory and led to a research study of special survey techniques by the Sedimentation Division in cooperation with the Physical Surveys Division.

This paper gives the results of application of parts of these experimental techniques, which are not yet published, to two portions of the Little Sioux River watershed in northwestern Iowa where a double check on erosion was made by comparing the volume of sediment accumulation with soil losses under two widely different physical conditions.

One of these checks (unit 1) was made on an alluvial fan from a 114-acre watershed about 3 miles northwest of Correctionville, Iowa, along the Little Sioux River Valley. The conservation survey showed a soil

loss of 71.7 acre-feet and the sedimentation survey showed 69.8 acre-feet of sediment accumulation. Another check (unit 2) was made approximately 2 miles west of West Okoboji in an old lake bed and on the adjacent slopes. The soil loss indicated by the conservation survey was 54.6 acre-feet and the volume of sediment accumulated in the lake basin was 52.5 acre-feet. Since no soil was carried out of unit 2, and only a minor quantity, mostly very fine or colloidal material, beyond the fan in unit 1, a reasonably accurate comparison of erosion and deposition could be made. The results of these studies indicate the accuracy that may be obtained in some areas by the conservation survey, supplemented by the additional measurements of erosion described below, in determining the extent of soil losses by erosion.

Soil erosion.—The volume of soil loss by sheet erosion in both of these studies was measured on the regular detailed conservation survey maps. (See figs. 1 and 2.) The area in acres in each erosion class was multiplied by the average thickness of soil lost

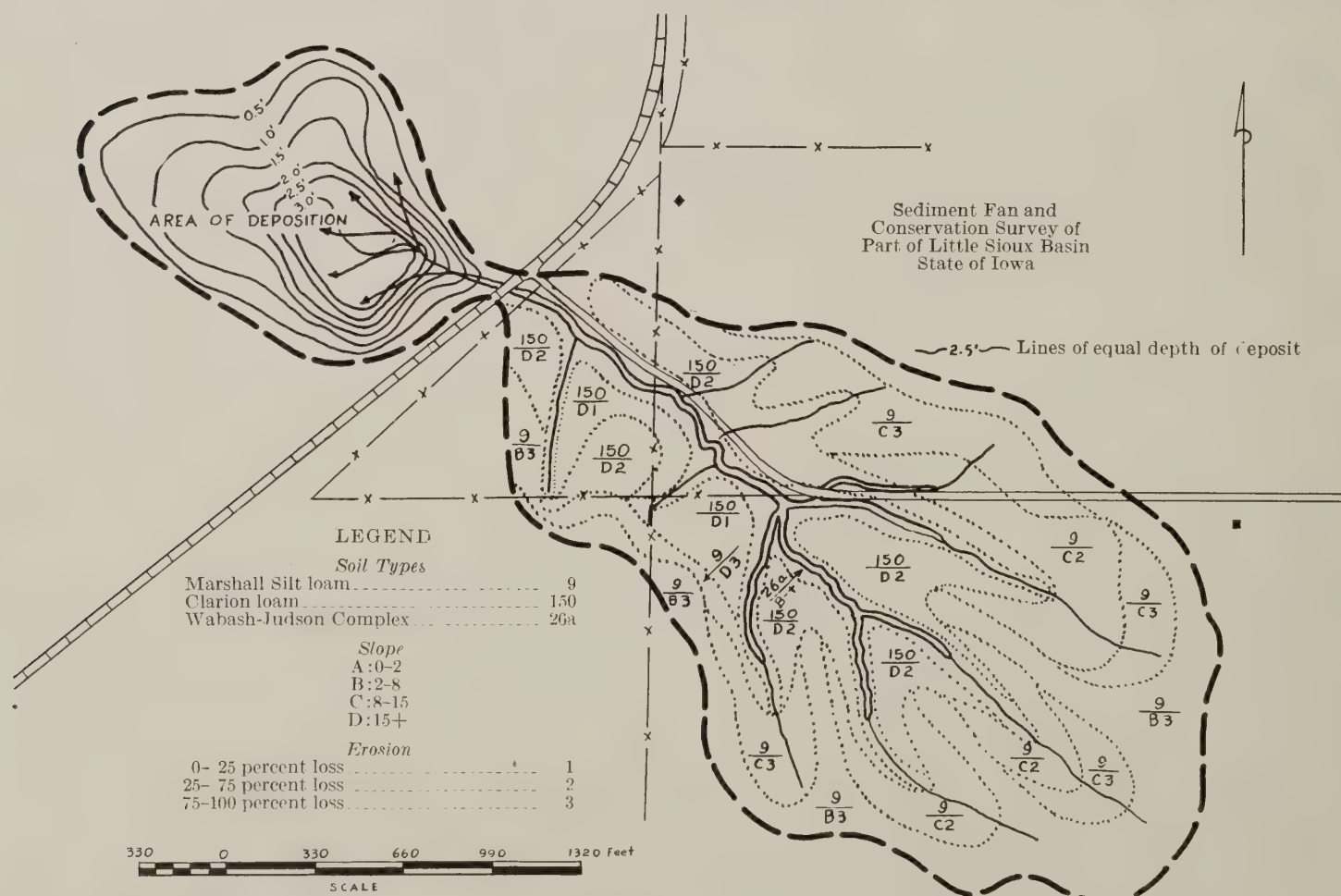


Figure 1.—Unit 1.

¹ Associate soil technologist, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

within these classes and the result indicated in acre-feet. An average depth of 12 inches for virgin soil was used in unit 1, and 10 inches in unit 2. The total volume of soil loss by sheet erosion in unit 1 was 49.7 acre-feet and from the second unit, 54.6 acre-feet, as shown in the accompanying table.

The volume of sediment coming from gully and roadside erosion was determined by measuring the cross-sectional area at frequent intervals and computing the volume for the linear distance between these cross-sections. The total volume of sediment coming from gully and roadside erosion in unit 1 was 22.0 acre-feet. In the second unit, the erosion was all classed as sheet erosion, since the water concentrations were in the form of rills not yet having reached the gully stage.

Table showing comparison of erosion losses and sediment deposits on alluvial fan and old lake basin, Little Sioux watershed, Iowa

	Unit 1	Unit 2
Area affected:		
By deposition.....	Acres 56.3	Acres 30.0
By erosion.....	93.9	60.0
Total.....	150.2	90.0
Percent of deposition.....	Percent 37	Percent 33
Percent of erosion.....	63	67
Volume of sediment:		
From gully and roadside erosion....	Acres 22.0	Acres 0.0
From sheet erosion.....	49.7	54.6
Total erosion.....	71.7	54.6
Total deposition.....	69.8	52.5

Distribution of modern deposit.—The volume of modern deposit was determined by making frequent borings on the fans and within the old lake basin. Lines were drawn through points of equal sediment depth with intervals of 0.5 foot (figs. 1 and 2). The area in each zone between these depth lines was measured and the volume of sediment determined by multiplying this area, in acres, by the average sediment depth.

The depth of the deposit on the alluvial fan, unit 1, thickens from the outer edge to the center, where the stream divides into numerous distributaries (fig. 1). The depth of deposit in the old lake basin, unit 2, thickens from the outer edge to the center (fig. 2).

The valley deposits are narrow along each tributary, within the small valleys of the small watershed, unit 1, up to within approximately 700 feet of the divide.

Sediment Basin and Conservation Survey of Part of Little Sioux Basin, State of Iowa.

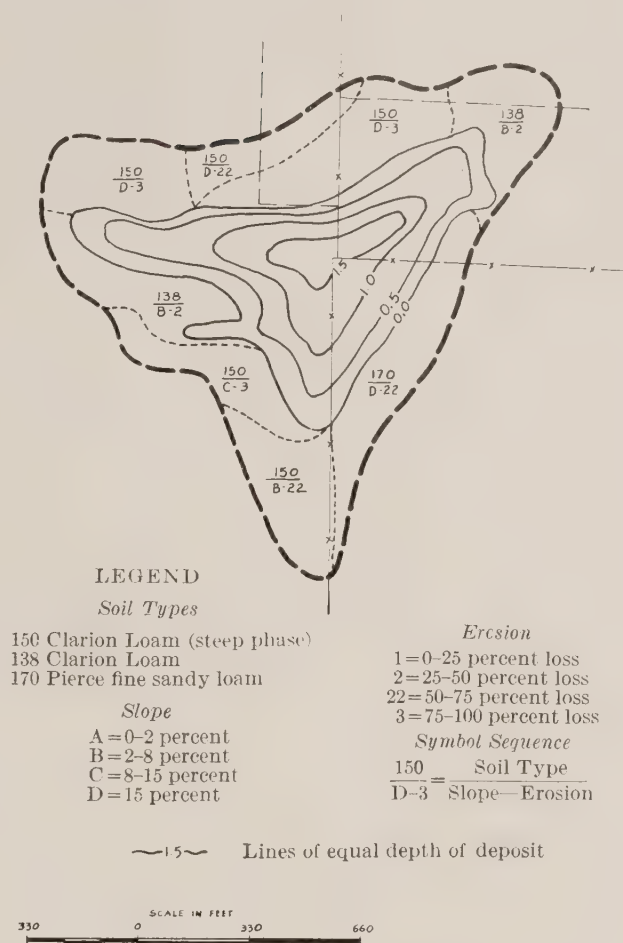


Figure 2.—Unit 2.

The average thickness of the deposit increases from 0.2 foot at the upper ends of the tributaries to 1.8 feet at the lower end of the main valley just above the road. The volume of sediment in these small valleys was determined by making borings across the valleys at frequent intervals and computing the volume for a valley reach between cross-sections.

These data were gathered by field survey methods, similar to those being developed in watersheds above reservoirs by the Sedimentation Division in cooperation with the Division of Physical Surveys.. The results show in a general way the relation between erosion and deposition and have value in determining sediment sources in relation to areas of sediment damage. It is also shown that the volume of erosion loss can be measured in some areas with reasonable accuracy by special conservation survey techniques.

Where market conditions justify planting of spruce or pines for Christmas tree production, single row contour plantings can be expected to produce very well shaped trees.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

LEGUMES FOR EROSION CONTROL AND WILDLIFE. By Edward H. Graham. Miscellaneous Publication No. 412, U. S. Department of Agriculture. Washington, D. C. 1941.

Had you been around certain Service offices when Graham's "Legumes" appeared in final form you would have heard the concerted "It's here at last!" that arose even before the book had been inspected for details. We have known for over two years that the volume was in the making, and we have needed it for much longer than that. Happily, it more than meets our expectations, and already the small green volume has found its place on the shelf closest at hand.

"Legumes for Erosion Control and Wildlife" is announced and reviewed in some detail in this department because without doubt the book is valuable to many other people far removed from Washington offices where an authoritative reference is an important part of equipment. Needless to say it is the only book listing and describing those species of the Leguminosae known to have some significance in connection with conservation of soil and wildlife. Not until recent years was there any widespread realization of the importance of leguminous plants in a Nation-wide program for the control of erosion and the protection and preservation of wildlife. Today the picture is entirely different. Farmers everywhere are enquiring about this or that erosion-control plant for one or another reason; highway and drainage engineers want legumes for bank protection; game managers and biologists—as well as farm women who love the flash of bluebirds' wings over the fence rows—want wildlife cover and food plants so that wild creatures will come and use them for habitats.

Biologists—Mr. Graham among them—have done much within the past decade to help along the soil and water conservation program by making studies of wildlife food plants and correlating their findings with the findings of erosion control research. Such correlation of facts points directly to the land, the farm in particular, where the farmer will recognize as a heaven-sent boon the plant that if used properly will provide him with fine forage, will improve his soil merely by being grown on that soil, will cure old gullies and prevent new gullies from starting, and at the same time will help create a refuge for the wildlife he wants on his land.

This book is, in fact, built around the interdependence of soil, vegetation and wildlife; it is intended to be used, was written, compiled, and published because of the need for it. Mr. Graham in his 20-page Introduction gives the facts, descriptive, historical and otherwise, about the Leguminosae, and it is so well done that the reader and user of the book forgets all about the old wornout line so frequently drawn in the attempt to separate the scientific from the popular or "for-the-million" style of writing. The Introduction is no less valuable than the lists and descriptions which make up the larger part of the book, because at this stage of conservation knowledge and activities it is important that those who use legumes acquire a clear understanding of the reasons for doing so. Farmers in particular should have the benefit of known and proved facts about the characteristics of different species,

their economically valuable products, their nitrogen-fixing qualities and why certain of them should be used in rotations, their disease susceptibilities and resistance, how to choose species for erosion control and wildlife, and the steps to be taken in establishing a stand of the desired legume and how to maintain it in good condition after it is established. All these important facts are explained and discussed in the first part of the book so that using the descriptions of individual species becomes a simple matter.

Approximately four hundred species are included in the carefully selected List of Legumes. Some of them—those already widely used for soil improvement and control of erosion—are treated with much detail; these include clovers, vetches, alfalfa, lespedezas, sweetclover and locust. Common names are given and listed alphabetically so that one finds no difficulty in locating the description, and for identification a set of 127 fine drawings, the work of Soil Conservation Service artists, is included at the end of the descriptions of individual species. The drawings also are arranged alphabetically. Suppose, for example, that you have heard people talking about the legume, white sweetclover, and want to know its characteristics, uses, and what it looks like. You will find it in the list of common names, with its scientific name *Melilotus alba*; then you will find its description among the M's in the main part of the book, and from this point you are guided to an illustration showing the plant itself.

Another useful feature of the book, especially for wildlife managers or farmers desiring to establish special wildlife habitats on their farms, is the list of almost three hundred animals and birds and the leguminous plants that each is known to use as food. This list works both ways, provided the person using it is willing to go to a little trouble to cross-check: favorite wild creatures may be encouraged, or those not wanted may be discouraged by eliminating their food plants as far as possible from the local habitats.

CONSERVATION

Conservation is not a program but a point of view. It is not a plan but a guide to planning. If we conserve effectively, conservation must be a broadly permeating motive that influences the use and handling of our natural resources, of our time and effort, and of our opportunities.

A current opportunity that we must not waste is the chance to use the assistance of the Soil Conservation Service and the Agricultural Adjustment Administration and other agencies to maintain or improve soil fertility and water supplies. Both fertility and water resources are essential sources of net income, of food supplies, of health and comfort, and of future happiness and security. The Extension Service must use this opportunity not only to conserve the soil but also to make true thrift a personal and family habit.—K. F. Warner, Extension Service, Washington, D. C.

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



Field offices should submit requests on Form SCS-37, in accordance with the instructions on the reverse side of the form. Others should address the office of issue.

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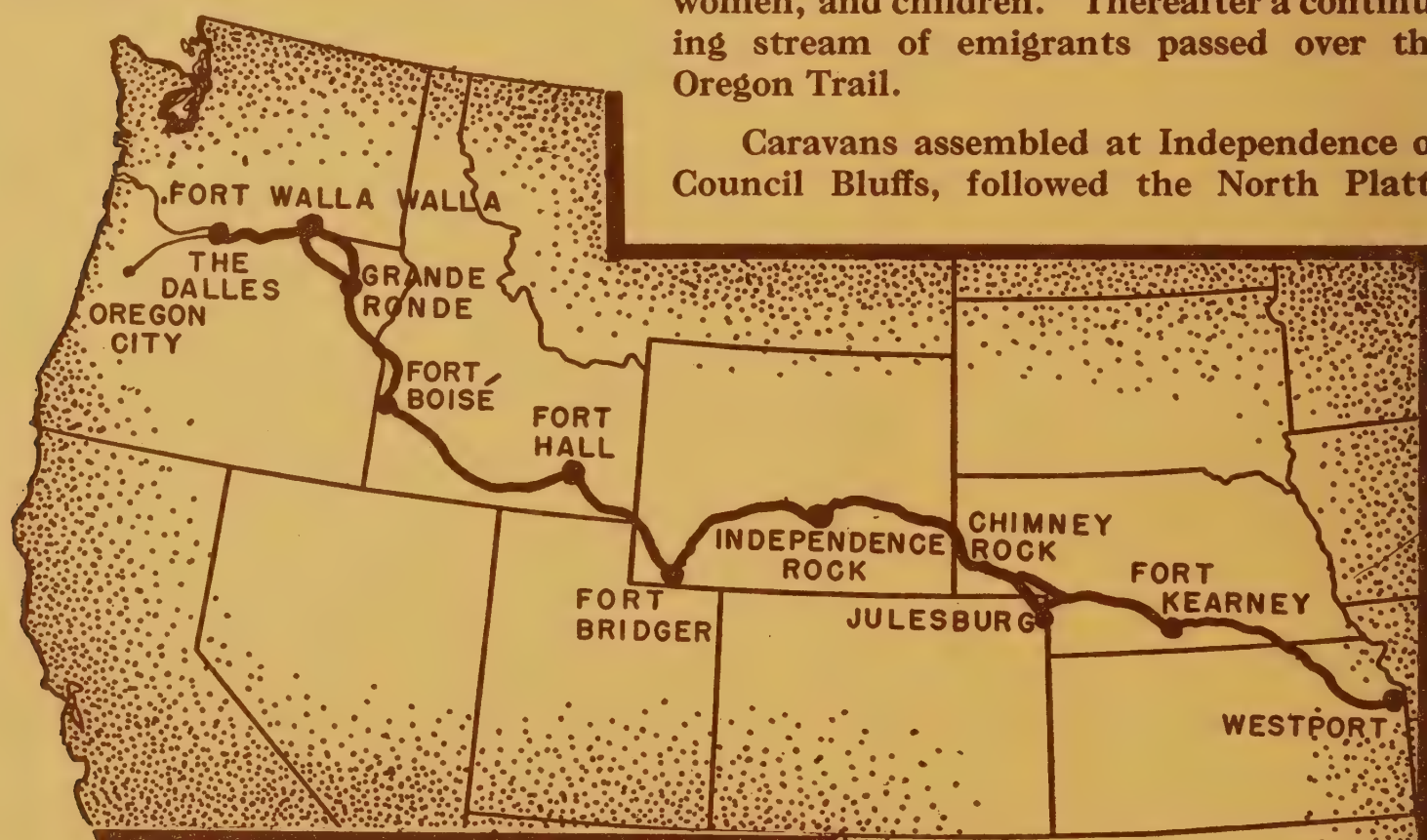
¹ From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

The Oregon Trail

The treaty for the purchase of Louisiana Territory was signed in 1803. The ink was barely dry when President Jefferson sent Meriwether Lewis and William Clark to explore the newly purchased land—to note where vegetation would best support settlement and establish overland routes to the Oregon country. Other explorers followed, sometimes in the footsteps of Lewis and Clark and sometimes zigzagging back and forth to find shorter routes and gentler slopes for the covered wagons of the settlers who were to follow. Gradually their paths merged into the Oregon Trail.

Then came the pioneers with their trains of covered wagons. Just a hundred years ago the first group set out on the 2,400-mile trek to the Pacific. Of the 500 that enrolled, all but 69 were discouraged by tales of the hardships that lay ahead. More followed the next year, and the Great Emigration of 1843 included a thousand men, women, and children. Thereafter a continuing stream of emigrants passed over the Oregon Trail.

Caravans assembled at Independence or Council Bluffs, followed the North Platte



across the Plains to South Pass, descended into the Great Basin, crossed the divide to the desert along the Snake River, and pressed on to the Oregon country. From the trading centers along the Trail farmers and cattlemen spread out in search of more fertile lands and fresh pastures. Life was hard along the Oregon Trail, but the reward was rich. Many of the pioneers lived to see Oregon admitted to statehood and the Louisiana Purchase converted into a vast inland empire.—Lois Olson.



JANUARY 1942

MORE ABOUT THE
NEW TILLAGE
PRACTICES



SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

E. H. Reed contributes a thoughtful article to this issue, urging the importance of the human factors in farm planning for conservation. "The needs and adaptabilities of the farmer must be considered, as well as the needs and adaptabilities of the land," he points out. The farmer's first object is to make a good living.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

	Page
Consider the Farmer as Well as the Farm:	
By E. H. Reed	153
Tillage and Crop Residue Management:	
By L. S. Carter.....	155
Humptulips and White Salmon:	
By H. H. Bennett	159
Singing Plowboy Plows Crooked To Win:	
By Glennon Loyd.....	169
Floods in the Navajo Country:	
By L. L. Harrold.....	172
Cooperation in Fire Fighting:	
By A. E. McClymonds.....	174
Suggestions for Pasture Mixtures To Meet Vary- ing Conditions.....	175
Book Reviews and Abstracts:	
By Phoebe O'Neill Faris.....	176
For Reference:	
Compiled by Etta G. Rogers.....	Opposite 176
Reducing Highway Maintenance Costs Through Farmland Conservation:	
By George C. Moore.....	Back Cover

Front and Back Cover Designs

By Katharine Johnson

WELLINGTON BRINK
EDITOR

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CONSIDER THE FARMER AS WELL AS THE FARM

By E. H. REED ¹

"Farms should be planned according to the needs and adaptabilities of the land"—this statement has been made and repeated so many times that it has become commonplace to members of the Soil Conservation Service. From its inception, the Service has stressed the physical characteristics of the land in formulating programs for areas or plans for individual farms. With the development and use of land-use capability classes, a further attempt has been made to enable farmers as well as technicians to obtain a more clear-cut picture of the physical conditions and capabilities of the land and their importance in farm conservation plans. Consideration of the "needs and adaptabilities" of the land is, and always will be, essential in farm planning.

In too many instances, agricultural economists, of which group I am a member, have paid little or no attention to the physical capabilities of the land. A few days ago a bulletin on farm planning, written in 1941 by an agricultural economist, came to my attention. In this bulletin, size of business, combination of enterprises and productivity of enterprises were the chief factors considered. No mention was made of the physical conditions of the land as a factor in planning; nor was anything said about maintaining the productive capacity of the land—the chief capital resource. To use the vernacular, "My brethren, these things ought not so to be."

There is no doubt in my mind that physical characteristics of the land should be given more, rather than less, consideration in farm planning. But, certainly, physical factors are not the only factors—the needs and adaptabilities of the farmer must be considered as well as the needs and adaptabilities of the land. The farmer's chief objective in farming is not soil conservation. He is farming to make a living. To obtain the largest possible continuous income, he must utilize all his resources to the best advantage. It is the farm planner's job to assist the farmer in formulating a plan that will afford the most

efficient continuous use of his resources. His resources include, in addition to the land, his labor, his managerial ability, and his operating capital. All these must be taken into account in farm planning. In many instances, inadequate attention to these factors has resulted in plans which were not economically feasible and could not be put into effect for this reason. Farm conservation plans should be both physically effective and economically feasible.

Just as "there is more than one way to skin a cat," there is more than one system by which the productive capacity of a particular piece of land can be maintained. We might keep the land in cultivation with a short rotation and intensive conservation practices such as terracing and strip cropping; we might keep it in a rotation consisting of one year of a small grain and 4 years of hay, with simple practices such as contour cultivation or strip-cropping; or we might keep it in improved pasture. The alternative to be selected depends on the needs and adaptabilities of the farmer as well as the needs and adaptabilities of the land.

Some farm planners speak of "ideal" land use when what they are referring to is the most intensive cultivation the land can sustain while its productivity is maintained. The most intensive cultivation to which a given piece of land may safely be subjected is not necessarily the "ideal" use for it. Let us assume, for example, that all the land in a dairy farm consists of capability-classes I and II. From the capability standpoint, all of this land could be farmed in a 3-year rotation with simple conservation practices. Since this is a dairy farm, however, probably the "ideal" use for half of the acreage is properly managed permanent pasture. The needs of the farmer as well as the needs of the land must be considered.

Labor, managerial ability, and operating capital frequently are as important in determining land use as are the physical capabilities of the land. Recently I helped to plan a farm that contained

¹Head, farm management section, Soil Conservation Service, Washington, D. C.

40 acres of class III and class IV land which was idle, in addition to 80 acres in pasture, permanent hay and woods. The owner wanted a conservation plan for the farm and wanted to utilize this idle land. He was living on the farm, had two cows, some hogs and chickens, and a garden, but no machinery or work stock. He had a full-time job off the farm from which he would retire in 15 years. We discussed with the owner three alternatives for the use of this idle land, namely: (1) Rotation crops with a diversion ditch and strip cropping, (2) improved pasture, and (3) woods. After a full discussion of the advantages, disadvantages, and net income possibilities of each alternative, it was decided that this idle land should be planted to trees—this because for 15 years the operator will have but little labor to put on the farm, he has no equipment, and he does not want to supervise hired help. About half of the area is to be planted to locust so that after harvest of the first crop of posts it can be devoted to pasture if desired. The remainder is to be planted to trees to be utilized for pulpwood.

Had this been a full-time farm with labor, machinery, and equipment available, the class III land probably would have been devoted to rotation crops and the class IV land to pasture or meadow. In other words, the plan as formulated was suited to the needs of the land and the farmer. Were the farm to be acquired tomorrow by an operator who had labor, machinery and operating capital, and who must obtain his entire immediate income from the farm, the plan would not be suited to his needs. The farm would have to be replanned to include more intensive use of the land so that he could utilize his labor, machinery and operating capital and thus produce a larger immediate income.

The farmer's own personal plans for his farm business also must be taken into account. I recall one farm with a field next to the road which, from the physical standpoint, was admirably suited for strip cropping. The farm planner suggested that this field be kept in cultivation and strip cropped, but the farmer explained that he wanted this field in improved bluegrass pasture to serve as a "show window" for his purebred dairy herd. Since the farmer particularly desired to advertise his dairy herd, pasture

was no doubt the best use for this field.

Another field on the same farm was well suited to terracing, and the farm planner wished to terrace this field and keep it in a rotation of corn, small grain, and 2 years of hay. This would have been entirely satisfactory from the standpoint of conservation. The terraces were suggested by the farm planner partly because he wanted a demonstration of terracing in the community. The farmer, however, had been using alfalfa silage on another farm, and he preferred to use alfalfa rather than corn for silage on this farm. As he was part owner of a feed store, he could purchase concentrates at wholesale. Furthermore, the growing of corn would necessitate his hiring additional labor. Obviously, he did not want to grow corn, either for silage or grain. He wanted a rotation consisting of small grain, 3 years of alfalfa-grass hay, and 3 years of pasture. With this rotation, terraces were unnecessary and if installed would have been a demonstration of what not to do.

In this instance the farmer's experience with alfalfa silage, his ability to purchase concentrates at wholesale, and his shortage of farm labor were major factors in determining the rotation. Had this farm been owned by an operator who was unwilling to use alfalfa silage, who could not purchase concentrates at wholesale, who had adequate labor, and who did not especially desire to advertise his dairy herd, the use of strip cropping on the one field and terracing on the other with a 4-year rotation probably would have been the best alternative.

In farm planning, we should consider with the farmer all alternatives that will achieve conservation, and after a discussion of the advantages and disadvantages of each of these alternatives, select the one mutually agreed upon as best for the particular situation. In too many instances only one alternative is suggested. If this does not accord with the farmer's needs or wishes, a compromise is made which many times results in a physically ineffective plan. Usually, were other alternatives considered, one could be found that would be both physically effective and economically achievable.

Often, when questions are raised about a

(Continued on p. 173)



SOIL CONSERVATION

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TILLAGE AND CROP RESIDUE MANAGEMENT

By L. S. CARTER ¹



One type of large duckfoot or sweep subsurface cultivator.

FOR many years the prevailing tillage and crop residue management practices for the grain-growing lands of the Great Plains, the western intermountain areas, and the Pacific Coast have consisted of covering all crop residues as completely as possible during initial tillage operations, and then cultivating intensively for weed control and the development of a seedbed. Where a summer fallow system was followed, the stubble and straw, and other organic materials, were considered liabilities rather than assets in that they interfered with development of the loose, well-pulverized soil condition desired during the fallow period and for seeding operations. In many instances farmers believed that a seedbed of clean, well-pulverized soil was essential for seeding and a satisfactory stand of grain, and for this reason they burned or otherwise destroyed crop residues to prevent their interfering with tillage operations.

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Seeding stubble mulch fallow with a deep-furrow drill.

This type of crop residue management, along with the intensive tillage practiced in the principal grain-growing areas of the West, has greatly depleted the soils of their ability to absorb water during periods of relatively high rainfall, to retard run-off, and to resist the forces of wind and water erosion. Intensive or excessive tillage produces a single-grain or pulverized structural condition of the surface soil. Such a condition tends to reduce or retard the rate and extent of water intake—soils become compacted or puddled

during rainfall periods and hard or crusty when dry, so that the amount of surface run-off is increased and the final result is erosion by water. Furthermore, a finely divided or single-grain structural arrangement of soil particles facilitates the pick-up and transportation of soil material by wind, with the result that serious soil loss from cultivated land is suffered in areas having wind erosion problems.

Experiments and experiences of farmers during the past few years have brought to light the tremendous value of a rough, trashy soil surface condition for protection of the land against wind and water erosion. It has been found that a rough, cloddy surface, covered with straw or other organic materials, absorbs water at a much greater rate than a smooth well-pulverized surface. By this means run-off is retarded, moisture evaporation is reduced and the soil is protected against blowing.

During recent months numerous efforts of farmers, manufacturers, and others have been directed toward the development or adaptation of tillage implements and methods that will provide the desired mulching of soil surface under grain-farming conditions. In general, most of these efforts have been aimed at modification of existing equipment and the refinement of tillage implements. Some special types have been developed to meet particular conditions encountered in handling large quantities of residues, or to demonstrate fundamental principles before recommendations are made for general use. The development and use of straw spreaders for combines has increased tremendously since it was found that large quantities of straw, if properly spread, can be handled as mulch if stubble mulching implements are used in the tillage operations.

The condition of the land following initial tillage operations and during the fallow period will vary in different parts of the country, depending on the desired condition. In some sections a smooth surface, with all or most of the residues remaining on the surface and stubble in an upright position, is desired. Under other conditions a rough stubble mulch is believed to give the greatest protection against wind and water erosion. In the Pacific Northwest it has been found that a rough cloddy condition of the surface gives considerable protection, and in the development of tillage practices efforts are directed toward producing such a condition. Modifications of tillage implements are being made, to produce clods and bring them to the surface while all residues are left on top. It is believed that in the Great Plains and particularly where wind erosion is a problem, a smooth surface with most of the stubble in an upright position will tend to reduce the blow hazard and also will facilitate

collection and holding of snow. On sloping lands all these operations, whether designed to produce a smooth surface or a rough cloddy one, should be conducted on or as near the contour as is possible. Thus, in any attempts to modify existing equipment or develop new implements for tillage and residue management, the desired condition of the surface soil following tillage operations should be borne in mind.

In developing a stubble mulch system of grain farming through the use of crop residues and tillage, consideration must be given to the cropping system followed, the amount of residues available for mulching purposes, and the types of tillage implements being used by the farmer. Where a system of cropping and summer fallowing is practiced, the time of starting the tillage operations, and the number of operations required to destroy weeds and to condition the land for seeding, will vary from those employed under an annual cropping system. The amount of crop residues available for stubble mulching will depend on the methods used in harvesting the grain crop, the time of starting the initial tillage—whether fall or spring—and the amount of rainfall. The type of equipment being used by farmers will influence the number of operations required. Thus, since the farmers are familiar with them, initial attempts to inaugurate a stubble-mulching system of tillage should deal with modifications or improvement of these implements.

The ordinary moldboard plow may be converted to a very satisfactory stubble mulch tillage implement by removing the moldboard. Elimination of the moldboard results in an implement which lifts and breaks the soil instead of turning it over. Not only is most of the crop residue left on the surface by a moldboardless plow but, if the soil is dry, clods are formed and brought to the surface so that a rough stubble-mulched condition is produced. For plows of the quickly detachable share type, a narrow strap of steel is required in place of the moldboard as a support for the share and to protect that portion of the soft metal frog to which the moldboard was attached. Since this metal strap gives some turning capacity, the roughness of the plowed land and the amount of residues left on the surface can be controlled to some extent by its width when it is used to replace the moldboard. Removal of part of the moldboard will have a very similar effect on the operation of the plow.

Of considerable interest to farmers is the reduction in power required to pull a moldboardless or a modified moldboard plow, compared to that of the conventional type. Dynamometer tests have shown this reduction to be from one-fourth to one-third that of the ordinary



Condition of land after moldboard plowing and rod weeding.



Attachment for rod weeder to enable penetration of compact fallow, or to be used for initial tillage on light soils.

plow. This reduction in power, converted into cost of tillage operations, may be quite significant where large acreages are plowed and large power units are used.

A weeding operation should follow the initial tillage with a moldboardless plow, to keep down soil moisture losses through transpiration by weeds, to firm the seedbed under the mulch, to establish a subsurface moisture zone and to condition the mulched surface for absorption of water during the next rainy period. The ordinary rod weeder is one of the most effective and inexpensively operated weeder for working summer fallow land, after modified moldboard plowing. This implement, operating below the surface, severs

weed roots, compacts the lower portion of the plowed zone, works clods and trash to the surface and mellows the seedbed. Land that has had a sufficient number of rod weeding to meet the purpose of weeding, seldom requires any further preparation for seeding.

Seeding of grain on stubble mulched land may require some care on the part of the operator in getting the seed placed below the rough, mulched surface. It is most important that the grain be placed in the finely tilled, compacted, moist, subsurface soil zone to secure proper germination and stand. While the deep-furrow and the ordinary disk type of drill is most effective for drilling grain through a stubble mulch, almost any



Field cultivated with straight-blade cultivator. Volunteer rye 8 inches high at time of cultivation. Moisture conditions excellent 5 inches below surface.

drill can be used if the mulch is relatively light. For extra heavy mulches or a very rough, cloddy condition, some modification of the ordinary drill, or the use of a deep-furrow type, is necessary to do a good job of seeding. Numerous studies and observations have shown that satisfactory stands of grain can be obtained on seedbeds with a much rougher, mulched condition than was thought possible a few years back. Care should be taken to leave the surface in an undisturbed condition as much as possible during drilling, so that the young grain seedling will have some protection while becoming established. The clods and mulch on the surface after drilling are of great value in slowing down run-off while the grain is becoming established.

One of the most extensively used implements for initial tillage of stubble land, particularly in the relatively low rainfall area, is the one-way disk. This widely distributed machine is known by various trade names such as the disk tiller, wheatland plow, one-way, etc. The amount of mulch left on the surface during one-way disking is determined by the quantity of straw and stubble on the land, the size and curvature of the disks, the dryness of the soil, and the speed of operation. High speeds and moist soil result in extensive coverage of crop residues and unnecessary pulverization of the surface layer. One-way disking of heavy textured, dry soils, produces the very rough, cloddy condition which is the desired goal of initial tillage for some areas. Fall disking of extra heavy stubble, to promote some decomposition of the residues and prepare the land for summer fallow tillage, is done quite extensively in the higher-

rainfall areas of the Pacific Northwest. For moderate to light quantities of residues, spring disking is preferred over fall disking, since these light residues offer more erosion protection during winter in an upright undisked position. Fall disking is objectionable because the stubble decays and the quantity of mulching material for protection of the fallow land is reduced.

A number of straight-blade tillers or cultivators have been developed for use in grain stubble, particularly in those areas where wind erosion is a serious problem. These blades operate under the surface, sever weed roots, loosen the soil to a depth of 3 to 6 inches and leave the stubble in an upright position. The operation of a straight blade leaves a smooth surface, so desirable under some conditions, with all residues on the surface for mulching purposes. The depth of cutting can be regulated to meet the need according to different soil, climatic, and weed conditions. One example of the straight-blade type of cultivators, known as the Noble blade, was developed by a farmer and used very extensively on his farms in western Canada. This and other similar blades have been used without other implements for tillage of stubble and for the control of morning-glory. In those areas where a rough, cloddy surface condition is desired, the Noble blade is not as satisfactory as some of the other subsurface tillage implements. Trials with this and other types of straight-blade implements are now under way in all principal grain-growing areas of the West.

(Continued on p. 173)

HUMPTULIPS AND WHITE SALMON

By H. H. BENNETT

Chief, Soil Conservation Service

WE left Bozeman by rail at twenty after nine in the morning and arrived at Spokane at twenty after nine the evening of the same day. Most of the journey—some 470 miles—was across the Rocky Mountains.

The Rocky Mountains at this latitude merely conform in size with the bigness of the country in general in this part of the world. It has seemed to me that from a commanding view anywhere near Billings, Mont., as from the Big Horns, you see the biggest country on the continent. There are no such far horizons in the Andes, or in the lofty ranges of Alaska. Mexico looks diminutive from her towering peaks, as compared with our northern Great Plains, particularly the Wyoming-Montana sector.

You don't see much farming through the Rockies after leaving the Bozeman Basin near the forks of the Gallatin, Madison, and Jefferson Rivers; it is chiefly grazing country, forests, and burned-over forests, with occasional fields of alfalfa, grass, and small grain along stream bottoms.

We were off to the Palouse next day, by way of the hill section lying between the Palouse proper and the mountains on the east. This mixed prairie and timbered area is even more broken than the Palouse and has much shallow soil, fragile like sugar and very erodible. One field is recorded as having lost 137 tons of soil per acre in 1940.

Doc Clanton's place near Rockford was so severely washed that, it was reported, he had quit farming about 1935 and was ready to quit paying taxes. The farm must have been badly "whipped" with gullying and sheet washing; we could still see the effects as we walked over it in September 1941.

Between 1935 and the present this place—the entire farm—has gone through a renovating process of soil conservation. The steeper, gullied slopes have been seeded to grass-legume



Pasturing 193 acres of sweetclover and grass seeded in the Palouse. Seedings of this nature are valuable as a soil builder, in controlling erosion, and as pasture. During one fall season 2,500 head of sheep pastured here and in the following spring 400 head of cattle grazed the same field.

mixtures and wheat has been worked into rotations with soil-holding, soil-building crops—legumes and legume-grass mixtures. Trees have been planted along the crests of high points to catch and spread snow—to protect critical slopes from accumulations of deep drifts and consequent severe localized erosion. Original acreage yields of 45 bushels of wheat had dropped to 8 or 10 bushels before installation of the conservation practices. But in 1941 the yield went back up to 40 bushels an acre.

We drove from the Latah-Rock Creek Soil Conservation District, on through the Pine Creek District and into the North Palouse District. Along the way we saw much plowing of wheat stubble without burning; we saw only one or two very small burnings of stubble on this 200-mile trip through the Palouse region. Farmers were plowing under wheat stubble, or plowing part under and leaving part on top as a protective cover (though not quite enough in some fields). In places sweetclover also was being turned under, to enrich the soil and improve its tilth. But what stood out over everything else—you saw then in any direction you chose to look on the entire trip—were the steep-slope plantings of sweetclover and grass-legume mixtures—generally alfalfa seeded with one or more of the various adaptable grasses.



Cut-over, burned-over Pacific Northwest forest producing some grazing but not many trees. This land is capable of more productive use through the right combination of grazing and tree management.

Here I saw that profound changes were taking place on the land—a revolution in land use, soil protection, and soil building. Some weeks previously I had seen another such change toward sound land use and conservation—in the old red hills of the South Carolina Piedmont country. I described that too as a revolution on the land; and here in the Northwest, as in the Southeast, the revolution was paying dividends in increased yields and increased income.

You see I had visited this Northwest country before and had a handy yardstick for computing progress. My first visit was in 1927—gathering ground information in connection with a reconnaissance survey of soil erosion in the United States (not the 1934-35 erosion survey but the preceding one).

At that time there was a very little, if any, interest in soil erosion. One section we examined in some detail was the country between Pullman and Walla



Patterns of conservation are invading the wheatlands of the Pacific Northwest.

Walla. Here we found (1) an abundance of sheet washing on summer-fallowed land, (2) nothing being done to stop erosion or slow it down—except in a single field—although much was being done to accelerate the process, and (3) around 80 to 90 percent of the what stubble being burned.

Then in 1930 I came back, looking for a suitable sight for an experiment station to study the problems of soil erosion and soil and water conservation. Cooperating with members of the staff of Washington State College, we scouted the countryside again. This time we found items 1, 2, and 3 as above, unchanged, and discovered an additional situation—some people didn't even know the meaning of the word "erosion."

We had invited ourselves, by phone, to talk to the county commissioners after their night session at Colfax. When we went in, the chairman asked if we were the people who wanted to be heard about "something or other."

"Yes," I told him, "we understood it would be agreeable to talk with you gentlemen a little while about what we think is a matter of great local importance."

"Oh, sure; we'll be through with this county busi-

ness in a moment, and then glad to hear anything you want to tell us."

"We want to talk about soil erosion and the possibility of establishing an experiment station for studying the problem."

"Well," said the chairman, "I don't know what erosion is, but in a moment you can just go ahead and tell us all about it, whatever it is."

I undertook to explain the local and national erosion situation and made the plea that before it was too late we should look into the problem of conserving rich Palouse soil. When I was through, one of the big wheat growers present said, "You know, I have a lot of that stuff on my place, and it's not getting any better. Something's got to be done about it."

Well, we helped get the desired support and the station was established. Since then many folks throughout the region have learned about erosion. Not only that, they have done a lot about it on the land—conservation work, I mean.

Later, the erosion control demonstrations helped to arouse interest in and support for the movement; and now soil conservation districts are getting off to a splendid start through the Pacific Northwest. At the

time of this last visit there were 12 districts in Washington State, comprising more than 2 million acres of farm and ranch lands, orchards, woodlots, and logged-off lands.

Instead of the nearly universal burning of wheat stubble, most farmers now utilize the stubble to hold topsoil and rainfall. Instead of growing practically no soil-improving crops and being afraid to plow under green-manuring crops, growing and turning under sweetclover is rapidly coming to be an everyday farm practice. Instead of the common assertion I heard during my first trips to the Inland Empire—"But this is a wheat country! We don't know what to do with hay crops or grazing crops—there are no animals to consume such products,"—instead of this I saw livestock grazing on both grass and legumes. I also saw haystacks and learned that the animal industry aspect of the farm business is up and coming. Also, sheep and cattle on the way to and from high summer ranges in Idaho are held longer here in the Palouse for the excellent grazing that doesn't hurt the land and does help the farmer—by way of a new source of income.

On this trip I saw for the first time in my life a farm field of big bluegrass (*Poa ampla*). It was on a Palouse farm near Moscow, Idaho, and was successfully grown in combination with alfalfa. It had been cut for seed, making a satisfactory yield.

This is one of a group of grasses brought into the nursery at Pullman by Service technicians for testing as to suitability for controlling erosion or fitting into vegetative combinations that in any way provide direct or indirect benefit to eroding lands. Big bluegrass, along with a number of other native grasses, such as western wheatgrass, little bluestem, big bluestem, blue grama, and sideoat grama, was never previously cultured on a field scale—so I have been informed. They, and others, have been brought into commercial use through the endeavors of the various nursery testing stations of the Soil Conservation Service. The collection and sale of seed of these promising new grasses—new in the sense of domestic use—is gradually developing new enterprises for seedsmen and farmers.

Next day we joined a group of land technicians, irrigation specialists, economists, railroad people, and others for a look at the area within which irrigation farming is to be established on the more suitable lands as soon as water is available from the great water-conservation and power project at Grand Coulee.

The party had an excellent opportunity to see the general lay of the land and the effects of erosion as the result of recent rains on summer fallow, and to

study some of the principal types of land and their agricultural capabilities at the three sites selected for this purpose—flat land with deep soil, rolling land with deep soil, and flat to undulating land with shallow soil.

From Ephrata we set out early next morning for the Trans-Cascades via the Moses Coulee and Douglas County Soil Conservation Districts and Stevens Pass. We spent some time on the 12,000-acre tract covered by the Billingsley-Maxwell-Carter-Meyer cooperative agreement with Moses Coulee District, beginning in Sage Brush Flats and extending down into the Coulee itself. Under this joint agreement the four men pooled their ownerships and lease rights in order to carry out a mutually beneficial system of fencing out trespass stock and dividing their range into five pastures to facilitate deferred and rotation grazing. Springs were developed for watering places. The size of the pastures and herds was based on topography, range capacity as determined by survey, and availability of water. A number of cattle trails were built so that the animals could graze both the Coulee lowlands and the plateaus high above.

One of the ranchers told me that this four-way agreement was paying dividends, particularly by reason of better cattle and increased length of the range grazing period.

Bob Billingsley, one of the parties to the four-ply ranch agreement, lives way down at the foot of the basalt bluff, on the east side of Moses Coulee. It's a beautiful situation—worthy of a story in itself. Rich coulee-bottom soil, flat, cozily situated—and much like one of those places you like to dream about for retirement purposes. There are cherries, apricots, melon fields, a garden of highly diversified contents, alfalfa fields—and finally, water arranged for the convenience of all.

None too much rain here, but floodwaters come down the Coulee from dryland farming areas and ranches somewhere upstream (up-Coulee, rather). This water, with the aid of dykes and ditches, Billingsley spreads over the alfalfa and other plantings to produce excellent crops.

Not only is the floodwater used to high advantage; the run-off from a stock spring, developed up-country under the conservation program, is directed on to a small turbine that provides electricity for the farm.

We lunched with the supervisors of the Douglas Soil Conservation District at Waterville. I had noticed some severe erosion on sloping land in that vicinity, the result of recent rains on fallow fields where most of the wheat stubble had been rather completely

turned over and covered—"black fallow." Wherever a good mulch of stubble had been left on the surface, little or no erosion was observable. I called attention to this, and one of the local wheat growers explained that use of larger disks was one cause of recent deterioration in the effectiveness of stubble-mulch farming as practiced in this locality. It seems that recently a good many wheat growers have changed from disks of 22-inch diameter to 26-inch diameter, and that these larger disks cover the stubble more thoroughly than those of smaller diameter.

Later in the afternoon we reached the 408,000-acre Snohomish Soil Conservation District, near Everett, where, at present, control of streambank erosion, pasture and woodland improvement and management, and drainage work are among the principal activities.

On the way over, we were a bit saddened, while passing through the apple country, at the sight of so many uprooted apple trees. In places entire orchards had been pulled out. This was the result of an accumulation of untoward economic conditions that have been plaguing the apple industry for a number of years. Orchards that could not ride the tide of low prices any longer were giving way to other crops of greater promise. Some of the uprooted trees were of the finer varieties, others were of inferior quality.

We spent some time next day interviewing a number of farmers who have been assisted by Service foresters working with the CCC camp and operating through a Washington Forest Products Association functioning as a local cooperative. On some of the farms we found that one of the chief problems was timber management. Around 50 percent or more of many of the farms is occupied by second-growth timber, mainly Douglas fir and mixtures of cedar, white fir, and alder. It is said that during the first season, 1940, more than \$15,000 worth of forest products were marketed by the local members—not so much, but still it is \$15,000 they were not getting before. The Association had 69 members, and between 35 and 40 participated in the cutting.

I asked Jasper Storm, near Sultan, if he had been helped by the Service foresters. "Yes," he replied. "Without the SCS help, we could get little or nothing for our timber. Contacts and sales are made for the members of the co-op that individuals couldn't make for themselves. The buyers wouldn't be interested in the small amounts we have to sell individually. But they are interested when we throw in together through the co-op. Besides that, I have a conservation plan now for the management of my woodlands and for the establishment of a pasture."

What has been accomplished on this tract—accomplished with astonishing rapidity—makes a powerful story of the practical possibilities of economically utilizing natural resources in accordance with sound principles of conservation. Here was a tract of 360 acres, most of it covered with second-growth. The owner was getting very little from it, aside from firewood and a little pulpwood. It was necessary to get outside employment for a living. It was difficult to meet payments due on the purchase price.

Without going into details, a conservation plan for management of the woodland problems on a portion of the tract and the development of 12 acres for pasture was prepared; and then an agreement was entered into in October 1940, for execution of the plan.

The financial returns from 80 acres of woodland, to June 1, 1941, were reported as amounting to \$1,940, or \$24.25 an acre. It was pointed out that the net return to the owner on a stumpage income of \$8 an acre would amount to \$640. Actually the farmer did the bulk of the work himself and so got pretty much the whole \$1,940.

The amazing result of this first year of conservation operation is that all Storm's debts were wiped off, his taxes paid, and he purchased 160 additional acres of second-growth land. Thus, in less than 12 months, what looked like a hopeless situation has been turned into a profitable enterprise, promising security for the future.

People often ask us, Is conservation practical? Fellows like Jasper Storm are our evidence that not only is conservation practical, but that few farmers can afford to do without it.

Another member of the co-op, Dan Barker, a logger, bought a tract consisting of 100 acres of farm land and 120 acres of what he called "brush." It was reported that when his neighbors used to come in and ask for wood, Barker would say: "Sure, take what you want; there it is." Then a conservation technician worked out a complete farm plan for him and induced him to join the co-op—though somewhat reluctantly.

I was told that as a result of what was done, the co-op in 1940 paid him \$280, stumpage, for the poles and piling alone on 40 acres of the 120 acres of so-called "brush" land—where the neighbors had been helping themselves to firewood, etc.

Among various interesting conservation practices on the Barker place—pasture improvement, woodland improvement, etc.—I ran into a planting of flat peas (*Lathyrus Sylvestris*) that seemed to be getting a good start in a very heavy stand of fern. On another farm flat peas appeared to be on the point of taking the ferns

for a ride. At any rate they were wrapping themselves about the unwanted plants much after the manner of the South American tree killer, *mata palo*. If this native perennial pea does work out according to present indications, we shall have something of momentous value—an eradicator for one of the bad weed pests of the Pacific Northwest coast country.

In the Montesano-Elma-Oakville Soil Conservation District of Grays Harbor County, we had the opportunity of carefully examining streambank erosion control work along several streams, as well as other phases of district conservation work.

This District is near the wettest part of the United States—the Olympic Mountains. At Wynoochee Oxbow, 9 miles north of the district boundary, 43 inches of precipitation fell during the first 21 days of December 1933 and an annual total of 184.56 inches was recorded in 1931. Nevertheless, droughts occur here at times and are conducive to forest fires and crop damage.

Six large rivers flow through the district—the Chehalis, Satsop, Wynoochee, Wiskah, Humptulips, and Quinalt. Floods appear to have been accelerated since extensive logging operations pushed back deeper into the headwaters. The record high was recorded on the Chehalis in 1937. Run-off records show that on the Wynoochee the agricultural and cutover (completely deforested) portions of the watershed have a higher per acre run-off during the peak months of flow than the mainly forested upper watershed, in spite of the much heavier rainfall over the latter type of country.

The alluvial lands of this region are highly productive and support many farmers. They are perfectly suited to the extensive dairying industry of the locality and also to highly specialized farming, such as the production of garden seed.

The first farm inspected was the W. J. Wharton tract on the Satsop, where across the river we saw the worthless gravel-bar remains of what once was an 80-acre farm of rich Chehalis silt loam, ruined permanently by stream-bank erosion. To keep the Satsop where it belongs Wharton has dumped along his eroding banks many loads of debris, consisting of anything from old cars to bedsprings. He has also stretched a wire cable near the base of the undercutting bank for collecting river debris. Along the line of the cable, piles of driftwood have accumulated and a gravel bar is now building up which, thus far, has effectively protected the bank. Later we saw similar effective control work on the Wynoochee. In other words, man here has cooperated with nature in a way that has caused the destructive force of

stream currents to turn to the business of building up a protective barrier against its own land-destroying depredations.

Some people quibble about spending money on river control, usually those who look at productive land in terms of real estate deals. They profess to think that when an acre of productive soil is lost, we have lost just its value as real estate, which in this instance may be \$150 or \$200 an acre.

But the way we soil conservationists look at it is that we have lost the basis of an entire community. It isn't what Wharton and his neighbors have lost. That is bad enough, of course. It is what all of us have lost, this year and next year, this decade and the next. The 80-acre gravel waste across from the Wharton place may never produce again. Certainly it won't for perhaps hundreds of years. And so, the permanent loss of 80 acres of land having a productive value of say \$150 an acre per decade would amount in 100 years to a monetary loss of \$120,000—if one might be permitted to figure it this way.

Up on the Wynoochee, at John Zak's place, the job of bank control necessitated the cutting of a straight channel through a gravel bar in order to bring stream flow under orderly behavior. The technicians have skillfully located the new channel so that its upper end contacts a straight reach of river instead of a curved section such as would have permitted cutting of the banks of the new channel to start immediately.

Here the rampaging stream not only was cutting out some of the most productive land to be found anywhere, but the buildings were threatened and also a steel bridge. The cutting of the 1,700-foot channel involved the moving of 30,000 cubic yards of gravel. The job was completed the day before we arrived.

From the Zak farm we drove out into the logged-off and burned-over uplands, where there was a splendid bird's-eye view of a vast area of stumps, fern, brush growth, and pervading silence, with here and there islands of young conifers. Here is good soil, much of it—thousands of acres, lying idle, land capable of producing rapid-growing trees, excellent grasses and grass-legume pastures; and undoubtedly capable also of supporting many families, under the right kind of farm-forestry system. I have seen such land standing idle in Oregon, land that was denuded of forest by a fire that occurred some 80 years ago—good land still producing worthless brush and nothing more.

Probably something can be done to get the better of these lands back into productive use. On one farm—the M. C. James farm in the Snohomish Soil Conservation District—I saw such stump land put back into



Leaving part of the wheat stubble on the surface effectively protects the land from erosion.

use by seeding red clover and timothy between the stumps after the best logs had been recovered from the waste of the original lumbering operations and the useless material burned. The notion some people have that logged-off land can't be used for agricultural purposes until the stumps are pulled did not hold on this tract. Grass and legumes are being grown, and livestock is doing the harvesting.

While discussing the possibilities of salvaging firewood, cedar logs, and other usable wood from the waste of the original logging operations, Mr. James spoke of farmers who buy coal for fuel. Could you imagine that—with firewood scattered all over the ground, thousands of acres where firewood is in the way!

We could not very well overlook Puget Island Soil Conservation District. It is just one-tenth the size of a ranch I had visited only a few days previously in Montana—a 50,000-acre ranch. Even so, even if this is the smallest soil conservation district in the United States, it is still a very important one as well as a highly interesting one.

Conservation of the productivity of the land by means of rotations and the growing of legumes to improve the soil, and betterment of drainage conditions

are among the more important problems being dealt with on this heavily populated island in the lower Columbia. Progress is being made with the district work and there is talk of expansion to take in part of the mainland.

By way of interest, we saw here in this smallest of all soil conservation districts the smallest farm I recall ever having seen in this country. And on this diminutive farm—with a total acreage of 1.1—a novel system of farm management was in use this year.

Peppermint is one of the important crops of Puget Island. This small-farm farmer is also a fisherman by profession, and during the season he goes fishing and actually gets paid for it. This year he put his entire farm of 1.1 acres in peppermint, bought three sheep and left them in complete charge of the outfit. When he came back from the business of the fisheries he found the sheep had dutifully eaten all weeds and grasses, but not one mint leaf. Most mint farmers weed their fields three or four times a year, but not this fishing-mint farmer. Besides, he made a better-than-average crop—72 pounds of peppermint oil, and the price was \$3 a pound.

And now, up the Columbia—to the locality of the White Salmon. (You don't fish for 'em or eat 'em;

it is just a section of the country around where the White Salmon River enters the Columbia.) Here is the Underwood Soil Conservation District, located mostly in Klickitat County. Really pretty country. From the Columbia River gorge the road rises rapidly to high, dissected plateau country from which on a clear day the view sweeps magnificently across the Columbia, across Hood River Valley in Oregon, and on to the snowy summit of Mount Hood. Turn around and another lofty peak—Mount Adams—rises majestically above the world about.

The district started out with 14,000 acres, but was later increased by referendum to about 320,000 acres. A variety of problem areas are included, dependent primarily on physical condition of the land, accessibility, and climate. It was encouraging to find that the Service technicians aiding the district recognized these basic problems and were adjusting their thinking and planning to accord with the inescapable conditions imposed by nature.

One of the principal difficulties in the fruit section along the lower White Salmon has been clean tillage of orchards resulting in considerable erosion, especially on the steeper slopes. We saw one fairly large orchard that had been abandoned because of erosion.

Farmers are beginning to grow protective and soil-improving cover crops, to till their land on the contour, and to take cognizance of the capabilities of the land.

In the section east and south of Glenwood we saw an abandoned sawmill and a good many abandoned farm houses and fields on good red soil capable of

producing good grass and grass-legume mixtures. Some of the farm houses seemed in good condition. Most of them were painted, but the yards about them and the fields were grown up to weeds. Evening shadows were gathering, the people were gone, there was silence—a ghost country, you might have called it, with ghost farms.

This country looked like other places I had seen, where people came in, took off the timber, and left without leaving very much in place of the natural wealth they had harvested and taken away. Then others came and opened up land for wheat farming. Wheat farming failed because this, almost certainly, is a grass-legume, livestock-timber country. Trees grow splendidly and there is considerable second-growth that could be brought into good forest condition with a little attention and protection from fire. Something could be done, no doubt, in growing hay for winter feed for the livestock of such localities as Glenwood, and probably also for locally raised livestock. At any rate, we saw one field with a mighty good stand of alfalfa.

The district, with the assistance of conservation specialists and the help of other agencies, has a promising opportunity, I believe, eventually to put the better parts of the present large area of idle land to work for the welfare of mankind.

From this point, near the end of the Oregon Trail, we turned our steps from the land of rushing rivers with their strange Indian names—from the Pacific Northwest—toward other parts of this great Nation.

REDUCING HIGHWAY MAINTENANCE COSTS THROUGH FARMLAND CONSERVATION

(Continued from back cover)

important matter has resulted in water entering and leaving highways to the detriment of all concerned—entering from farmland above and discharging over

other farmland below. Many highways, roadbanks, and highway ditches are affected by consequent gully-ing and flooding, while soil and debris deposit on lower farms. Most of the rainfall on the highway surface runs off rapidly, and farmlands and highways alike are at the mercy of land-users occupying the slopes above. This situation is particularly acute in many of the glaciated sections of the Northeastern Region.



Before treatment of highway banks near Bennington, Wyoming County, N. Y.

The past 6 years, however, with cooperation between landowners and highway officials encouraged by the Soil Conservation Service have proved that the two groups can prepare a joint plan of water control to the advantage of both. The private landowner may be the first to receive protection by the application of a soil conservation plan for his farm, but the highway below the farm is benefited soon after.

Financial savings to the township of Cohocton, in Steuben County, western New York, are typical of the values of soil conservation to highways: Conservation measures have been adopted on 155 acres of farmland constituting the entire drainage area above three-fourths of a mile of gravel highway. Two-thirds of the drainage area has slopes ranging from 5 to 15 percent. About one-fourth is represented by slopes of 15 to 25 percent. Practically all of the soil is well drained.

This highway was closed to traffic three times during the summer of 1938 when erosion debris clogged road ditches and culverts. Power machinery and a considerable amount of hand labor were necessary each time to clear the debris from the highway in order to make it passable. Most of the highway damage was caused by surface water from two farms adjoining the road—the farms of G. M. Rynders and Fay Jackson. In the fall of 1938 the two farms comprising the drainage area were planned for erosion control. Land use within that area was replanned as follows:

	Before planning	After planning
	Acres	Acres
Cropland (including permanent hay, homesteads, highways).	129	118.5 (5.5 not treated)
Pasture.....	26	28.
Plantation.....	0	8.5

Photographs 1 and 2 show the Rynders farm in 1938 and 1939, viewed from the Jackson farm.

Eight thousand feet of diversion terraces were completed in the fall of 1938. The waters from them were discharged in woodland or on pastures. Reforestation plantings were finished in the spring of 1939.

Forty percent of the cropland treatment (contour tillage, contour strip cropping, and establishment of permanent hay) was completed during 1939, and by 1940 ninety-five percent of the new practices were established. No changes were made in the highway location or in original culverts. The Soil Conservation Service assisted in the construction of the diversion terraces and reforestation. It is estimated that the total cost in cash to landowners, had the construction and planting been done on a contract basis, would have been about \$375.

Records from Soil Conservation Service rain gauges one-half mile from these farms showed that the duration and intensity of some of the heavier summer rains were similar before and after the soil conservation measures were adopted on the farmland.

The following maintenance costs (exclusive of snow removal) on this three-fourths of a mile of gravel highway were furnished by the Cohocton town superintendent of highways, George F. Ross:

Year	Labor	Machinery	Total
1935.....	\$153.35	\$123.00	\$276.35
1936.....	102.30	87.75	190.05
1937.....	72.25	40.25	112.50
1938.....	137.40	110.75	248.15
1939.....	15.00	3.00	18.00
1940.....	14.75	3.00	17.75

Mr. Ross made this statement: "The sharp break in maintenance costs between 1938 and 1939 speaks for itself. The saving can be either passed on to the taxpayer in the form of reduced taxes or used for more permanent improvements elsewhere. Now that the soil conservation districts law in New York legalizes the use of town equipment on private land for erosion control, the money saved on highway maintenance might be used to further soil conservation and increase the permanent benefits to our town roads. Similar cost reductions on other highways in our township also are the result of farmland conservation. Where farmers have not taken steps toward conservation, the maintenance cost of highways has had a tendency to increase each year."



The same road, after backsloping and seeding of banks.

Highway bank protection, combined with farmland conservation, has given about equal public benefits. Roadbanks stabilized by bank sloping and revegetation prevent the silting of drainage ditches in summer and in winter make snow removal easier. The sloping and lowering of the highway banks allows much more room for the snow plowed from the highway.

Walter Kreutter, supervisor of Bennington township, Wyoming County, made the following remarks: "A highway demonstration project was recently completed by the Attica CCC Camp of the Soil Conservation Service. Formerly we worked at least 2 days each year with power shovel and two trucks, cutting back slides and filling washouts. These operations cost us about \$100 yearly. Since completion of the demonstration, our total maintenance expense is about \$3.50 yearly. This expenditure included one day's labor for mowing grass on seeded and sodded banks and ditches and a small amount of grass seed sown on some bare spots. The past year, we also saved at least \$40 in snow removal. I believe that one great benefit from this roadside improvement work is the removal of traffic hazards. The educational value to the Town Highway Department also is highly important: it has demonstrated what can be done to improve highway safety and that roadside maintenance costs can be greatly reduced."

The highway to which Mr. Kreutter refers is only about one-half mile long. It receives excess water from 16 acres of cropland above. The soils are poorly drained and the slope is 10 percent. The 16 acres are now contour strip-cropped. Diversion ditches carry the water away from the highway and discharge on an improved pasture. Before the demonstration, the road banks were 5 to 30 feet high and nearly vertical. They were graded at a 1.5 to 1 slope and seeded. The road ditches were sodded. A highway culvert was lengthened and an outlet built for it. Now both private and public lands have a safe coordinated water-control system. Photographs 3 and 4 show one section of this highway. Before improvement the most serious damage occurred below the crest of the hill.

Attica township, also in Wyoming County, reports a saving during 1940 of \$80 on eight-tenths of a mile of highway maintenance. This saving has resulted from soil conservation measures established during 1938-39 on farm land above the road and on the public right-of-way.

The highway banks cited above in Wyoming County were stabilized by a combination of sloping with sodding and seeding. Sites were always limed where necessary and heavily fertilized. Mulching

invariably ensured the success of a seeding.

Limited experience with the use of shrubs indicates that they can be used satisfactorily for revegetating road banks. In Madison County, N. Y., several hundred feet were planted to low-growing shrubs with a spacing of 18" x 18". They included red osier dogwood, honeysuckle, gray-stemmed dogwood, Virginia creeper, barberry and bittersweet. A 95-percent survival was secured by a mulching of rye straw. Use of shrubs is limited by the availability of stock and the higher cost of planting. They may not give complete protection as quickly as sodding or seeding.

Whether shrubs are used or grass, the site preparation is vital to success. Sloping the road bank to the angle of repose is necessary. When this is not adequately done, partial failure of the revegetation is inevitable because sloughing will occur. Of equal importance is the interception of surface water from above. Farmland conservation will arrest most of that water. The balance may be diverted to woods or pasture land or safely discharged into an outlet, perhaps a highway ditch for which protection from erosion is established. In any event the installation of conservation practices for the entire drainage area is desirable for the most effective conservation of soil and disposal of surplus surface water.

These examples are illustrative of what wholehearted cooperation can accomplish. Townspeople and those interested in better roads should have a lively interest in soil conservation because the aggregate benefits of farmland conservation yield returns to others besides farmers.

LETTER FROM VICE PRESIDENT

Mr. HUGH BENNETT, *Chief*

Soil Conservation Service

DEAR HUGH: When I was in North Carolina last spring and in Colorado this summer, it seemed to me that I saw unusual evidence of the effectiveness of the work of the Soil Conservation Service and the Triple A. There were several years when it seemed to me as though the work were progressing very slowly, but now you can see the effects with your eye. This must be a great source of satisfaction to you.

Thanks for sending me the latest issue of your magazine "Soil Conservation." It is good to make people soil, grass, and tree conscious.

Sincerely yours,

(Signed) H. A. WALLACE.

SINGING PLOWBOY PLOWS CROOKED TO WIN

By GLENNON LOYD ¹

BILL Moy, a Wisconsin dairy farmer on the Mississippi River bluffs near Mondovi, is quite a hand with either a guitar or a plow. He can sing and yodel too; but, best of all, he can "lap over" the neatest of furrows on the contour. He displays more than a little talent when he sits down to strum his guitar or to turn a furrow with his two-bottom plow.

Unexpected fame has swooped down on William S. Moy. He is now the "American Contour-Plowing King;" and the soil conservation districts of northeastern Iowa, southeastern Minnesota and western Wisconsin, where the Nation's first contour plowing match was promoted, have the satisfaction of knowing that they have excited new interest in soil saving.

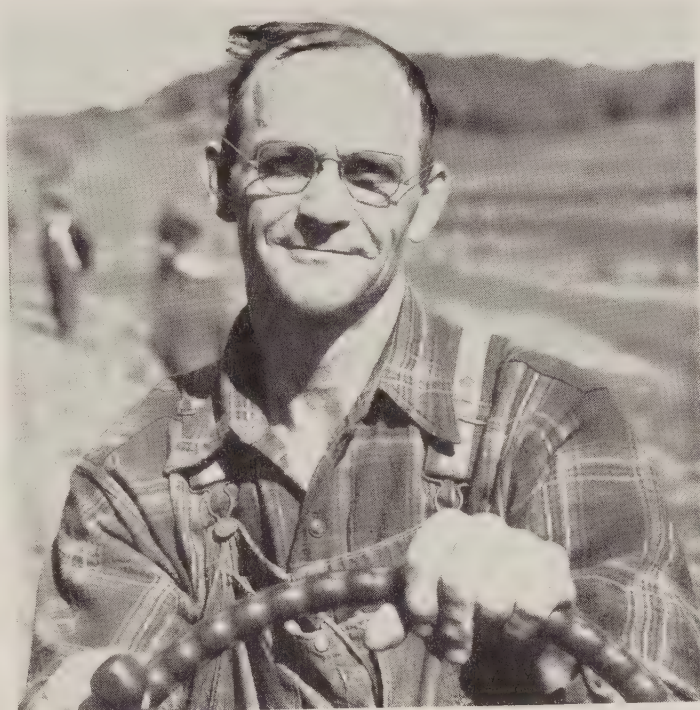
Plowing matches are not new. Hundreds of them had been held in the Middle West before, but nearly always on level land. Straightness of furrow and even land ends were of primary importance on the judges' score card. The ideal created by the level-land matches traces back to the assumption that plowing "as straight as a crow flies" was just as important as keeping paint on the barn. In too many instances, a man's ability to plow straight determined whether or not he was considered a good farmer in his community.

Thus it is significant that in this new activity the districts have made another contribution to the tremendous task of getting people to use common sense instead of a mistaken notion when it comes to cropping sloping land.

Known as the "singing plowboy," Moy won his plowing title in the tri-state finals of the First Dairyland Contour Plowing Match last fall (October 8) near La Crosse, Wis. Two thousand spectators turned out for this new rural sports spectacle on the Lester Hoeth farm in Mormon Coulee which is recognized as the "cradle of strip cropping" in the United States.

Moy is forty-five, and the father of six children. He and the other five finalists in the tractor division had won elimination matches at Eau Claire, Alma, Viroqua, and Mount Horeb in Wisconsin, Lewiston in Minnesota, and Garnavillo, Iowa, where a total of 34 plowmen vied for honors.

The thirty-four plowmen, all "dirt farmers" residing within soil conservation districts, were chosen and sponsored by officials of the local districts. In a few instances, local contests were held to choose the district's representative for the elimination contests; but because time was short most of the districts nominated their entrants—they were assisted by the



"A bit neater on his furrows," said the judges, and William S. Moy, the Mondovi, Wis., "singing cowboy," became the first contour-plowing champion in the United States.

county agents, AAA county officials, and Service workers.

The whole match—eliminations and finals—was set up and run off in 6 weeks. Attendance at the preliminaries and finals totaled 9,000, many more than anticipated in view of the fact that some of the eliminations were organized, promoted, and held in less than 3 weeks.

At the Mount Horeb contest, more than 3,000 spectators were on hand for the day's festivities. Side features included a contest for high-school agricultural students in laying out contour lines, demonstrations of pasture renovation, and the latest methods of hay harvesting. At Alma, one of the "extras" involved the construction of a broad-base terrace at the upper

¹Head, regional current information section, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

edge of the contest field. At Eau Claire, a contest division for horse-drawn plows attracted a lot of attention. The horse plowmen jokingly declared that the land chosen for them was too difficult for the use of a tractor. At Garnavillo, Iowa, interest was heightened by a plowing match between the Mayors of Decorah and Elkader—neither had ever been on a tractor before.

Rain fell on the mornings of the Iowa and Minnesota events, and a 2-inch downpour 36 hours before the La Crosse finals left the match site spongy. The contestants agreed that the La Crosse field provided an adequate test of their mettle, aside from its sogginess; it had been field stripped previously, but the strips were not on the true contour. Thus the plowmen found part of their lands on sod and part on corn stubble, and there were plenty of natural drainage ways to keep the men on their toes.

Trees on the upper slopes of the rugged hills in the Coulee were beginning to splurge their autumn hues, and the bright-colored tractors also added a touch of gaiety to the occasion. Moist furrows turned over by the two- and three-bottom plows glistened in the afternoon sun as the contestants skillfully drove their tractors back and forth across the hillside.

The 80-minute grind for the tractor plowmen followed a countywide horse-drawn contest in which four farmers, with reins over their backs, shuttled back and forth on a 20-rod stretch.

A small cannon's blast started the tractor contest. Rubber-tired tractor wheels spun, now and then, in the soft footing of the corn stubble, but the six experienced contour plowmen were not troubled. Showing their skill, and incidentally demonstrating the simplicity of contour plowing, they rounded out their opening furrows from one stake to the next. They yanked up their plows at natural drainageways and left the furrows jagged at grassed waterways and land ends. Five judges scampering up and down the slope, inspected the furrow slices and grassed waterways, and watched to see if a contestant failed to lap a furrow properly on a curve.

Age triumphed over youth in the end. Bill Moy, who got the judges' nod, was the oldest man in the contest. He won by a narrow margin over 19-year-old Halvor Brue of Hollandale, Wis., the youngest entrant. The land on both the Moy and Brue farms had been cropped on the contour for 6 years, so that neither was a stranger to this type of plowing. The Iowa representative, Albert Andera, Jr., of Calmar, placed third, and the Minnesota representative, Vincent Schafer of Lake City, was fourth. John

Williams of River Falls, Wis., and Hilton Jordie of Onalaska in the same State also finished.

All the contestants showed the true sporting spirit. Moy, accompanying himself on his guitar, sang a tune to measure up to his reputation as the "singing plow-boy." He told the crowd he was certain that his farm, where he had perfected his plowing technique, was the birthplace of the "sidehill gouger," the legendary beast that traveled around steep hillsides so much that its front and hind legs on the uphill side were shorter than those on the downhill side. Moy is a real booster for a complete soil conservation program, and the home folks are proud of him. They held a Plowman's Dance in his honor and followed up with a community testimonial banquet.

The supervisors of the La Crosse County Soil Conservation District sponsored the finals, and Chairman R. W. Davis raised \$180 for cash prizes. The money was divided among the tractor contestants, the horse contestants, and the teams of high-school agricultural students who took part in a contest in laying out contour lines. Moy's prize was \$30.

Tractor and farm implement companies gave all-out support to the new activity. Before the event their factory representatives tuned up motors and helped contestants make plow adjustments. Implement firms in the vicinity of the matches gladly provided equipment for the plowman who had to come too far to transport his own equipment. Local civic groups provided entertainment and prize money. Local Soil Conservation Service representatives assisted in selecting contest sites and staking out fields for the contestants.

The score card, which explained that contour plowing is "judged primarily for effectiveness and conserving water and soil," allowed 20 points for opening and closing furrows; 15 for adherence to the contour; 20 for waterways and land ends; 20 for conformation of furrows; 5 for trash coverage, including distribution of trash under furrow slice; and 20 for uniformity and evenness of width and depth.

Extension services and the soil conservation committees of the three States also lent a hand in promoting the matches. Judges at the finals were O. R. Zeasman, Wisconsin extension soil conservationist; Harold Hill, member of the Wisconsin AAA committee; and the three farmer members of the Wisconsin State Soil Conservation Committee, George Nygaard of Chaseburg, M. H. Ward of Mondovi, and Paul Weis of Madison.

What did the matches accomplish? That is not an easy question, but we do know positively that they stirred up a lot of healthy interest in the principles of soil-saving farming. Certainly they were timely and



Part of the 2,000 spectators at the first "crooked row" plowing match. They climbed the long slope and stationed themselves at vantage points. One of the contestants here rounds a curve.

appropriate—Secretary of Agriculture Wickard had warned that in the "food for freedom" drive farmers were going to guard against such depletion and destruction of soil as resulted from the ripping up of the hillsides in the first World War. The district office at Alma reported that after the match they noticed a sizeable increase in the number of farmers wanting their fields contoured.

Many of the districts already are making plans to promote county matches next year. Some have mentioned informally that they would like to serve as host at either the elimination or finals in 1942. Furthermore, sponsors of some of the straight furrow plowing matches have indicated they would like to add a "contour" class to their future contests. Tractor and implement companies naturally were interested because the matches gave some public recognition to the improvements and changes in design which they have made to facilitate plowing on the contour.

Last but not least was the wholesome publicity the matches gave the cause of soil conservation. They literally moved soil conservation news from the inside to page 1 of the local papers in that area of the three States. The contour plowing match—and soil conservation—became the subject of commendatory editorials in newspapers and state farm publications. A

Nation-wide news photo service used a photograph of the winner. A member of the regional office staff discovered the "crooked furrow" winner's picture in the *Birmingham News—Alabama*. *Successful Farming* magazine had a photographer at the match, with instructions to cover the event for a two-page four-color spread. Nation-wide press services "trunked" stories of the match.

This event led to the making of a 1-minute movie trailer in which scenes of the plowing match and winner were tied in with the farmers' "food for freedom" drive for more meat, milk, and eggs. In late October, the movie short already had been booked in more than 130 theaters within and outside the contest area.

Ralph H. Musser, regional conservator, believes that the matches "will go a long way toward bringing about widespread recognition of the advantages and benefits that come from contour tillage."

"I expect to see a spread of interest in similar contests over a much broader area next season," he remarked. "This is in the direction along which all farmers should proceed, if our land is to be saved for future generations."

Nobody has a copyright on the contour plowing match idea; anyone wanting further information on the matches can get it by writing to Mr. Musser.

FLOODS IN THE NAVAJO COUNTRY

By L. L. HARROLD¹



"A wall of water between 2 and 3 feet high . . ."

WATER in normally dry arroyos is an unusual sight in the arid Southwest. Even the natives are startled to witness in a dry channel the rapid approach of a black wall of water, sticks, stones, and other debris accompanied by a roar like that of a panzer division in distant battle. Tourists ask questions: "It didn't rain here—where did the water come from?" and "How did it concentrate so fast?" The answers are logical and interesting.

In the Navajo country, a few miles north of Gallup, N. Mex., rising 2,000 feet above the plains to an elevation of about 8,800 feet, Chusca Peak stands out majestically against the deep blue sky when not engulfed in storm clouds. This peak plays a part in the Navajo tribal rituals. It is on this peak and the surrounding plateaus and ridges that summer cloudbursts pour their water in large quantities. From these upland areas waters start their way down the steep slopes into deep canyons, picking up soil and foreign material along the way. Angrily, these waters pound against huge rocks and earthen sides of deep arroyos, seeking always the peacefully sloping channels of the plains, 2,000 feet below. It is no wonder that in crossing the dusty lower reaches of these streams, the traveler is astonished to see downstream a dry streambed and upstream a mad rush, literally a wall, of swiftly moving water and debris.

The accompanying photograph shows this phenomenon—a wall of water between 2 and 3 feet high, moving toward the photographer at a velocity of about 9 feet a second, or 6 miles an hour, or about twice as fast as the ordinary walking speed. The front of the wave is a moving dam of sand, sticks, stones, and trash pushed ahead by the water behind.

¹ The author is hydraulic engineer, hydrologic division, Soil Conservation Service. The article is based on data furnished by D. S. Hubbell, project supervisor, and T. E. Utterback, assistant hydraulic engineer, Navajo Experiment Station, N. Mex.

In steeper canyons the wall of water moves with higher velocity, and stones the size of an automobile are rolled along with a sound like the rumble of thunder.

As the flood wave passes out of the steep canyons into the arroyos of the plains and as each flowing tributary contributes its small debris dam to that of the trunk stream, its front becomes a moving dam of debris containing little water, but comprised mostly of trashy material, churning over and over. Behind these moving dams, in the arroyos of this Navajo country, the debris load carried in suspension by the flowing water at times is as high as 30 percent of the volume.

The scarcity of water in the arid Southwest makes conservation of water a vital part of agricultural planning for this region. In the headwaters of the large drainage basins where stream flow is intermittent and irrigation from subsurface waters is too costly, the silt-laden flood waters are spread over large areas of range land. Within recent years several problems have arisen concerning this practice: What are the immediate and long-term effects of the diverted arroyo waters and their accompanying sediments on native vegetation and soil? How do crops of corn, beans and oats, and the range itself, respond to irrigation by silty water? Research to determine answers to these questions is being conducted at the Navajo Soil and Water Conservation Experiment Station at Mexican Springs, N. Mex. Preliminary results, some of which are presented below, have been released in a progress report of this station for the years 1934–39 in publication SCS-ESR-9, dated March 1941.

The soils in the upper portion of the flood plains, for a distance of about 0.6 mile, became lighter in texture as a result of the increase in sand fraction. Soil moisture in the flooded areas reached 16 percent, or twice that in the untreated areas. Vegetal growth showed a marked increase in the flooded area where little sediment accumulated, whereas heavy deposits had the effect of decreasing the perennial vegetation. It was observed that galleta and western wheatgrass came up through a 7-inch blanket of silt within a single year; and in places western wheat, over a period of 4 years, came through 30 inches of silt and increased in doing so. Under small silt blankets, galleta increases greatly.

During 1938, 18 inches of silty flood water, and in 1939, 36 inches, were spread on 0.01-acre plots where

crops were being grown. The silt deposited on these plots averaged 185 and 353 tons per acre in 1938 and 1939, respectively. Corn yields for 1938 were as follows: irrigated with silty water, 34.4 bushels per acre; watered by precipitation only, 15.5 bushels. For 1939, silty water 57.8 bushels, and precipitation only 2.9 bushels per acre. Oat yields for 1938 were 5,200 pounds of forage and 48.7 bushels of grain per acre for silty water, and 850 pounds of forage and 7.2

bushels of grain per acre for precipitation only. In 1939 the oats did not mature because of lack of moisture at the time of planting and considerable time thereafter.

The progress report referred to contains additional interesting data on soil type changes; chemical, physical and bacterial changes in plots of similar soil texture; ground water fluctuations; and detailed summaries of rainfall, run-off and soil loss, and soil moisture from several watersheds.

TILLAGE AND CROP RESIDUE MANAGEMENT

(Continued from p. 158)

The widely used duckfoot cultivator lends itself to certain modifications that provide very satisfactory stubble mulch tillage. By making the duckfoot shovels larger and longer, tillage can be accomplished with a minimum of surface disturbance, but the blades must be operated parallel to the surface to prevent a furrowing effect. If the frames are built higher and the standards placed farther apart, and if wide blades or sweeps are attached in place of the duckfoot shovels, an ordinary cultivator can be made that will operate under a heavy grain and weed stubble. When properly assembled and operated this implement destroys weeds, leaves the stubble in an upright condition for collecting and holding snow, loosens the soil underneath, and promotes the development of a mulched surface. Subsequent tillage to destroy new weed growth, firm the seedbed, and keep the surface in a condition for water absorption is most important.

One of the latest and most promising developments

along tillage lines is the shovel bar attachment for rod weeders. This tool consists of a heavy bar to which is attached a series of small shovels with the rotating square rod placed between the shovels and the bar. Flanges are provided to attach this assembly to the frame of the weeder and the rotating rod to the drive shaft. This attachment enables the weeder to penetrate relatively hard ground such as is encountered in initial tillage or compacted fallow. The implement is especially adapted to initial tillage of stubble on light-textured soils, and for weeding where summer fallows become compacted by summer showers. By going over stubble immediately after harvest, to kill weeds and loosen the soil, mulching can be accomplished with this implement at a much lower cost than for any other type of subsurface tiller. After the initial tillage to loosen the soil 3 to 5 inches deep, the shovel bar attachment can be removed. An ordinary rod can then be attached for weeding during the remainder of the fallow period.

CONSIDER THE FARMER AS WELL AS THE FARM

(Continued from p. 154)

physically ineffective plan, the reply is, "That is the economics of it. The farmer could not make the desired changes so we planned it this way." This is an indication of lack of economics. In the first place, a plan that permits unnecessary destruction of the land is not economically feasible. In second place, consideration of other alternatives which would not interfere with the farm income and would utilize the farmer's labor, managerial ability and operating capital to maximum advantage, probably would lead to a plan both physically effective and economically feasible. Here again the situation on the particular farm must be taken into account. If the farm is large in proportion to available labor and the

farmer can utilize roughage, probably all the land of capability class IV and much of class III might be devoted to hay or pasture. On the other hand, if the farm is small, or land is high in price and labor is available, much of the class IV land might logically be kept in cultivation with intensive practices, even to the extent of bench terraces on high-priced fruit or vegetable land. No infallible rule-of-thumb can be used in determining the "best" use for a given piece of land. But, in my opinion, we should revise our statement of planning to read thus: *Farms should be planned in accordance with the needs and adaptabilities of the land and the needs and adaptabilities of the farmer.*

COOPERATION IN FIRE FIGHTING

By A. E. McCLYMONDS¹

ONE day last summer a workman finished cleaning out a spring in the Flat Creek Valley, 16 miles south of Terry, Mont. He stood up, rolled and lit a cigarette, dropped the match and went about his business.

This was in mid-forenoon. Shortly after noon, the town of Terry received a call for help. The rancher and his helpers could not cope with the fire started by the carelessly dropped match. Flames already had burned over 2,500 to 3,000 acres and were spreading rapidly. Within an hour a hundred men from Terry, with equipment, were at the fire. An hour later it had been extinguished.

Undoubtedly men would have turned out as willingly anywhere else, because serious prairie fires have been the bane of the great open ranges of the West since their settlement. But those men from Terry were organized, prepared for quick action.

The Soil Conservation Service is vitally interested in this fire-fighting organization because all of Prairie County is included in a Federal land-utilization project. Furthermore, with 19 land-utilization projects embracing 24 million acres in the Northern Great Plains Region, fire control is a matter of major concern. An excellent feature about this organization is that it came into being solely on the initiative of the townspeople, although now the Soil Conservation Service plans to make some specialized equipment available to it. I believe the Service can well afford to spend some time organizing manpower for emergencies, such as fires the ranchers cannot handle. Without doubt this kind of work ties in closely with National Defense and with the objectives of soil conservation districts at all times.

It is true that for some years ranchers have been well organized, in the older projects particularly—caches of fire tools are to be found at strategic places and for the most part there has been little difficulty in handling fires. The Terry organization is interesting, however, in that it systematizes the help of townspeople, for emergency beyond the town's limits. They are ready when they are needed.

George Brubaker, cashier of the Terry bank and acting fire chief, explained it as quoted in the following: "The fire-fighting organization we have in Terry has grown out of experience. This country has had prairie fire problems ever since it was settled, and some of the fires have been extremely serious affairs. Ranch-

ers are too widely separated to cope with bad fires, so they must be in a position to turn to a place where men are available quickly. In this county, Terry is that place. Formerly we had no organization of the manpower."

The present set-up was formed in 1938 through the efforts of the commercial club and the county agent at Terry.

"It is easy to get such a thing started, although of course someone must take the lead," Brubaker continued. "Now, every merchant has available a car and one man, for call at all times. Each car is equipped with a shovel, a bucket and wet sacks, and the county has provided a truck to carry barrels of water. Calls for help are made through the telephone exchange. If it is a general alarm, the telephone operator notifies all cooperators; if otherwise, the calls are rotated so that no one firm bears the brunt of the burden."

Each car provides transportation for five men. One of the five is a leader because, it is explained, when a call is received other men must be recruited from any place or places where they may be congregated.

"Our organization is designed to get help to ranchers expeditiously in cases of emergency, where they cannot handle the fire themselves, and nowadays they lose no time in making use of it," Brubaker remarked. "We are not called for all fires by any means, as the ranchers can handle most of them unassisted. But when we are needed, we are needed badly and confusion must be avoided. Actually, we have been called out only seven or eight times a year to stop fires that undoubtedly would have burned over large areas had we not been able to provide plenty of help without delay."

Behind this spirit of cooperation is a full realization by the townspeople of the relationship between their prosperity and the well-being of the ranchers, Brubaker pointed out. "We can't make a living here unless the farmer is prosperous. The ranchers are dependent upon the range grasses for feed for their stock, and in turn the town is dependent upon the agriculture of the county. True, there is some irrigation in Prairie County and there will be a little more, but it has been my observation elsewhere that irrigation alone is not the answer. Irrigated crop farming coupled with livestock farming seems to be best for this country."

The spirit at Terry probably is not different from that in any other town in the range areas, but the

(Continued on p. 175)

¹ Regional conservator, Northern Great Plains Region, Soil Conservation Service, Lincoln, Nebr.

Suggestions for Pasture Mixtures to Meet Varying Conditions

III

Q. I want to establish a soil-conserving, profitable pasture in the Southeast. What type of mixture shall I use?

SOUTHEASTERN STATES (sections 2-a and 2-b of the map)

Mixture for moist, sandy soils:

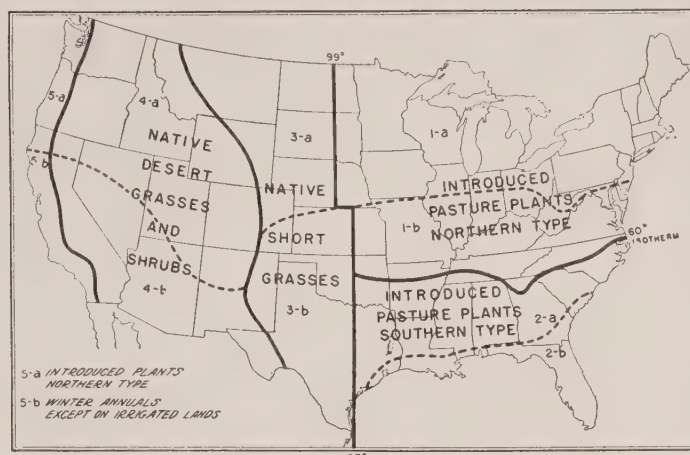
	Pounds per acre
Carpet grass.....	5 or 6
Dallis grass.....	3 or 4
Lespedeza.....	12 or 15
Total.....	20 or 25

Mixture for clay, loam, or clay or silt loam soils:

Bermuda grass.....	5 or 6
Dallis grass.....	3 or 4
Lespedeza.....	10 or 12
White clover.....	2 or 3

Total..... 20 or 25

Common, Kobe, and Tennessee 76 lespedezas are the varieties to use in this region. Bermuda grass is



usually started by planting pieces of sod rather than seed.

For *short ley* pastures in the Southeastern States, a mixture of small grain and lespedeza is recommended. The small grain furnishes late fall, winter and spring grazing; the lespedeza provides summer and early fall grazing.

MONEY VALUE OF WOODLAND

Studies and surveys have shown that the properly managed farm woods can be made to produce a yearly net or periodic income to farmers comparable to that secured from other crops grown in the Ohio Valley. When the soil value and productive capacity as well as other factors are taken into consideration over a period of years, the income from the managed farm woods may even exceed that secured from other common crops.

From 1911 to 1939, a 33-acre farm woodland in northeastern Ohio produced an average net income per acre of \$9.24. This undoubtedly includes the labor income.

A southern Indiana farm woods, for which records are available from 1807, produced an average net cash income of \$5.60 per acre per year.

Higher records are shown for special products: \$20 per acre per year where part of it was from maple syrup; \$22 per acre per year for 36 years from a black locust plantation in Ohio.—LeRoy Frontz.

COOPERATION IN FIRE FIGHTING

(Continued from p. 174)

people here have gone forward energetically with real accomplishments in the matter of organization. When fires break out Prairie County can call on a group of experienced men, ready to move on a moment's notice and capable of leadership.

Twenty-three hundred bushels of wheat, which has served its purpose in experimental storage by the Grain Storage Investigation section of the Bureau of Agricultural Engineering and Chemistry, has been transferred to the North Dakota unit of the Soil Conservation Service for use in winter feeding of game birds when that becomes necessary.

Many cooperators are learning that they can get as much cash from their woodlands by making a light cut and selling each stick for the purpose for which it is most valuable as they can by selling the entire stand in bulk.—H. C. Mitchell, regional forester, Western Gulf Region.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

FARM SOILS, THEIR MANAGEMENT AND FERTILIZATION. 3rd edition. By Edmund L. Worthen. New York and London. 1941.

This text now covers quite thoroughly the soil-management problems the farmer encounters in the field each season of the year. It is a practical book, thoroughly usable by anyone connected with the farming business, whether tilling his own soil, helping to plan other peoples' farms, or preparing to teach in a school of agriculture. The book is revealing also when considered from the standpoint of the value of agricultural research: It is through such well-organized and accurate presentations that research findings are translated into working material. Evidently Professor Worthen of Cornell, himself a scientist, knows that research is valueless unless or until results are made available to the people.

The arrangement of "Farm Soils" is excellent in that it is particularly adapted to every day use. Chapters are divided into two separate parts, the first, "operations" and the second, "general information." It works like this: In the chapter on growing the crop, for example, the first part tells what the crop needs to make it thrive and produce and how to go about supplying those needs; the second part tells why—why fertilizers, why air and water, why different soils for different crops. All kinds of crops are treated throughout, so that the volume as a whole has much of interest for the highly specialized grower as well as for the general farmer.

One rather long section of the book entitled "Controlling the Water Supply of the Soil" includes valuable recommendations for laying out and installing drainage systems—every step of the procedure is pointed out and carefully described with permanent and efficient farm drainage as the objective. Irrigation farming, dry-land farming, and soil-erosion control are treated in this same section in somewhat generalized fashion, but since most of the soil-conservation practices now widely used in this country are included in other chapters it cannot be said that these subjects are neglected.

Very useful are those parts of the book that explain the use and benefits of legumes, and pasture management under varying conditions. The farmer who has in his farm library such books as "Farm Soils" will not need to take the hit-or-miss course in these important phases of land use—in this volume he is not only told what to do and when, but why he should choose one method instead of its alternative, and what rewards he can expect for his trouble.

A large part of Professor Worthen's book—some 150 pages—is devoted to an exceedingly detailed treatment of soil-fertility improvement materials. The user of the book is provided with directions for determining whether or not various crops need manure, lime, and the commercial fertilizers in single or mixture applications. Here as elsewhere the author gives the reasons for recommendations, and backs them up with experimental results from some of the top-notch experimental institutions in the country.

For purposes of the classroom, apparently, Professor Worthen has included at the end of each chapter a set of "community studies" and a set of "problems." The student is advised to "Visit, where available, a farm on which erosion-control practices have been

established. List the methods used and note their relative effectiveness." He is then asked to "Outline arrangement of crops for strip cropping where the rotation consists of two years of corn, one of oats, and three of hay." This is but an example—and these community studies and problems are far too extensive to be reviewed at length. They should be pointed out, however, as an important feature of this text, not only for the student but also for the farmer who is seeking better methods of soil management and a clearer understanding of the true effects upon soils of soil improvement practices.

The more specialized subjects are treated in chapters on management of garden, greenhouse, lawn and orchard soils. The book contains hundreds of classified references and is illustrated throughout.

THE SOILS THAT SUPPORT US. By Charles E. Kellogg. New York, 1941.

Introductions to scientific subjects usually make interesting reading, and this is no exception. For purposes of easy reading, apparently, Dr. Kellogg has omitted footnotes, credit lines and names of institutions and agencies responsible for the tremendous amount of research that today points toward more complete understanding of the soil of the earth and its relation to man. This makes the volume more or less a one-man book; and, certainly, the author knows his subject, writes with a pleasant and sympathetic style, and chooses carefully his phrasing so as not to discourage his reader in the approach to a most difficult and complicated science.

The book is designed, no doubt, for supplementary reading in schools. In simple language it explains the origin of soil and points out reasons for the wide variety of soil types over the earth's surface. Although "The Soils That Support Us" puts no great emphasis on conservation of soils as an urgent necessity at this phase and stage of man's existence, nevertheless throughout the book certain conservation methods and practices are described and explained as they have evolved from days of primitive farming to present modern land use for support of huge populations. As to the philosophy behind the reasons for soil studies and the conservation program in the United States, one chapter, entitled "Soil and Our Future," presents a rather wavering thought trend that were it expressed more definitely and vigorously might reverse the whole thesis of the book. It must be remembered, however, that Dr. Kellogg is essentially a soil scientist, whose aim is to locate, analyze and classify soils, rather than to protect and conserve soil resources for future generations to use.

Today, most young students, and students not so young, when beginning seriously the study of soil science, have in mind some practical application of knowledge after it is acquired. This book will serve the student well as an over-all picture, simply drawn, of what is involved in a necessary fundamental soil knowledge, and it will do this without allowing him to lose himself in a labyrinth of data and argument. By the time he has read the final chapter and finds himself encountering the four-part Appendix he will be interested in the simple explanation of soil classification and maps, and in the tabular arrangement of the characteristics of the Great Soil Groups and the landscapes over the earth's surface with which they are associated.

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Compiled by **ETTA G. ROGERS**, Publications Unit



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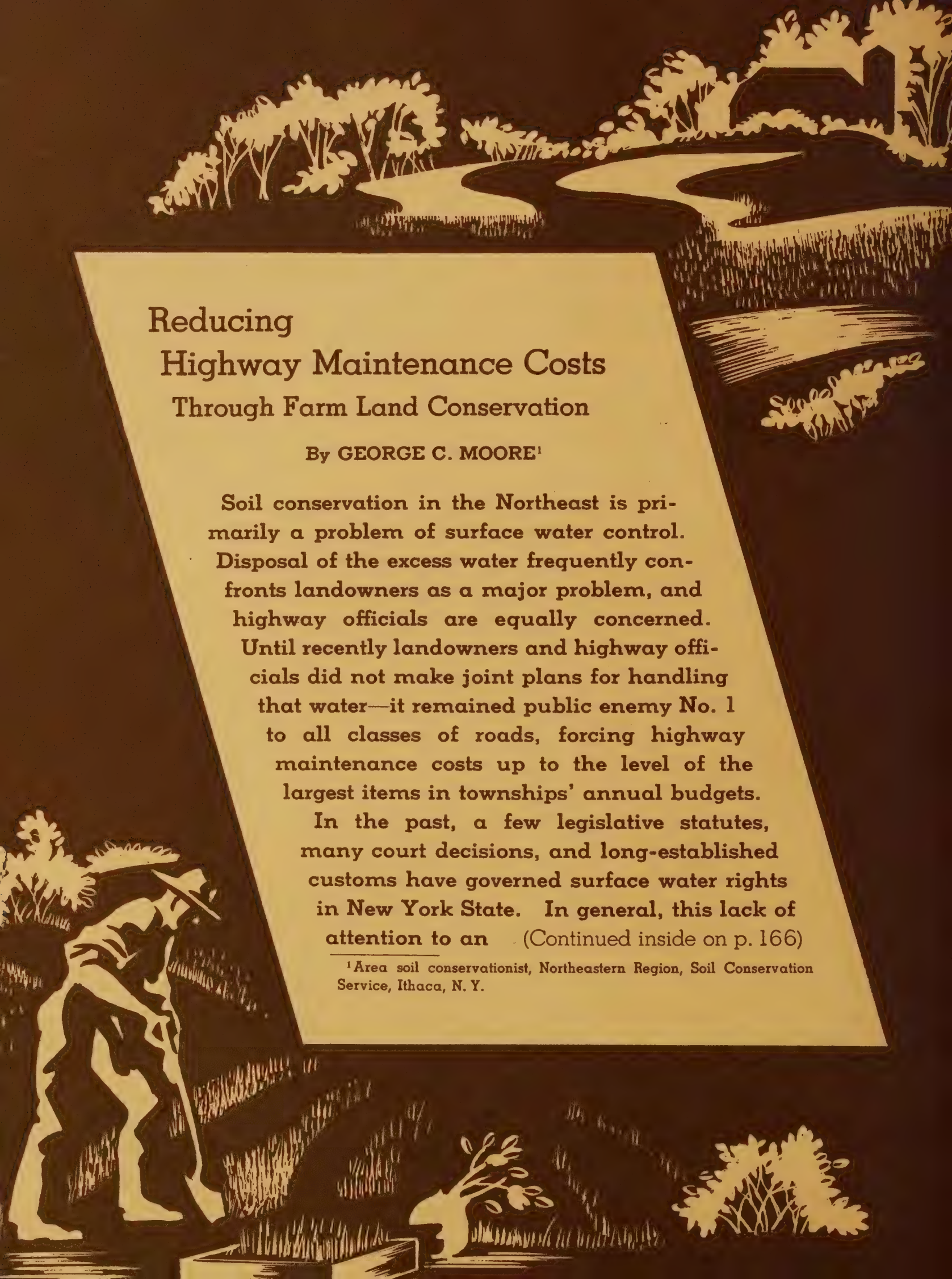
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¹ Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

² From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



Reducing Highway Maintenance Costs Through Farm Land Conservation

By GEORGE C. MOORE¹

Soil conservation in the Northeast is primarily a problem of surface water control. Disposal of the excess water frequently confronts landowners as a major problem, and highway officials are equally concerned. Until recently landowners and highway officials did not make joint plans for handling that water—it remained public enemy No. 1 to all classes of roads, forcing highway maintenance costs up to the level of the largest items in townships' annual budgets.

In the past, a few legislative statutes, many court decisions, and long-established customs have governed surface water rights in New York State. In general, this lack of attention to an

(Continued inside on p. 166)

¹Area soil conservationist, Northeastern Region, Soil Conservation Service, Ithaca, N. Y.



FEBRUARY 1942

**DISTRICTS GIRD
FOR WAR
PRODUCTION**

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

J. Phil Campbell in a convincing article, "An Agricultural Movement Marches On," statistically summarizes organization progress of Soil Conservation Districts . . . Lloyd Partain notes Oklahoma Defense Board recommendations for seasonal practices . . . Other pertinent reports come from Michigan, Arkansas, and the far West.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

Food for Freedom with Soil Conservation:	Page
By Lloyd E. Partain.....	177
District and Schools Cooperate in Handling Equipment:	
By Fred C. Burns.....	179
Pooling Efforts for Soil Conservation Work.....	180
An Agricultural Movement Marches On:	
By J. Phil Campbell.....	182
Conservation Comes to the Golden Gate:	
By H. H. Bennett.....	197
Erosion Control on Lake Michigan's Clay Bluffs:	
By B. A. Myers.....	206
Land for More People in the Mississippi Delta:	
By John G. Sutton.....	Back Cover
For Reference:	
Compiled by Etta G. Rogers.....	Inside Back Cover

Front and Back Covers

By C. E. Margraff

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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FEB. • 1942

FOOD FOR FREEDOM WITH SOIL CONSERVATION

By LLOYD E. PARTAIN¹

PATRIOTISM of the farm people builds higher and stronger their desires to contribute in the fullest measure within their power to the defense of democracy and all its ideals. These people are eagerly asking their neighbors, their leaders, and public servants in the agricultural profession, "What more can we do?"

The Government has told farmers generally what agricultural commodities are needed "to win the war and write the peace." Plans are developed with each individual farmer in order that he and his farm can make the maximum contribution. Fortunately, farmers can meet production needs and at the same time conserve soil and soil resources. To do this most farmers feel that they must have all the technical counsel they can get, together with good leadership and sound organization. Their purpose is to produce without waste—to conserve.

A current example of how Federal, State, and local agricultural workers are working with farmers through locally organized leadership is to be found in Oklahoma. Here the State Soil Conservation Advisory Committee has suggested to the Oklahoma USDA Defense Board a number of seasonal soil and water conservation practices which can be installed by farmers without technical assistance. The State Defense Board approved this list and sent copies to all county USDA Defense Boards in the State.

The practices reflect the thinking of representatives of the State Extension Service, the State Agricultural Experiment Station, and the Soil Conservation Service in the State. In transmitting these recommended practices, the State USDA Defense Board stated:

"Every farmer should prepare a complete long-time plan for maximum soil conservation on his farm where the necessary surveys and technical assistance are available. Where such assistance is not *immediately* available, we suggest farmers *select from the following practices those which are adaptable to his farm needs.* The establishment of such measures and practices should contribute to the Food for Freedom Program, as well as to a long-time plan of soil and moisture conservation."

County defense boards may select and recommend from the list those practices applicable to individual counties. Each farmer may then select such practices for establishment on his farm as are "in accordance with the desires of the farmer, equipment available, and the needs of the land" and which will aid in reaching his own "Food for Freedom" goals. The farmer can check the provisions of his 1942 AAA handbook and determine the soil building allowance benefits which are possible as a result of establishing these simple practices. He will find that most of those recommended are included in the handbook.

Farmers are urged to call on neighborhood, community, and county leaders and local representatives of agricultural agencies for assistance and guidance. County extension agents, SCS workers, FSA supervisors, vocational agriculture teachers, county and community AAA committeemen, and representatives of other agencies are listed as those being in a position to assist farmers in effectuating this work.

Local leadership in soil conservation is well developed in Oklahoma through the mechanism of soil conservation districts. More than 50 of these districts, covering more than 65 percent of the area of the State, are organized in Oklahoma. In each of these

¹ Extension-SCS soil conservationist, division of States relations, Soil Conservation Service, Washington, D. C.

districts, 5 supervisors and, in most districts, many more neighborhood or community leaders are taking the lead in getting work done on the land. Farmers in districts are a part of a going concern through which they can obtain information, get help as available, and democratically approach their problems. These districts, no doubt, furnish a clear channel through which county defense boards and the repre-

sentatives of other agencies can effectively reach groups of farmers with leadership that is ready to take hold and push the program.

Following is the list of recommended seasonal practices released to county USDA Defense Boards in Oklahoma. As the spring season comes on, the spring practices might well be reemphasized, by local newspapers and through other media.

SEASONAL SOIL AND WATER CONSERVATION PRACTICES WHICH CAN BE INSTALLED BY FARMERS WITHOUT TECHNICAL ASSISTANCE

Winter

- Planning a home garden for family food supply.
- Utilizing all manure produced on the farm.
- Protecting crop residues from fire and grazing.
- Make necessary farm machinery and equipment repairs.
- Sampling of soil and testing to determine acidity or alkalinity and phosphorus content.
- Removing undesirable shrub and certain weed species as cacti from pasture land.
- Protecting springs and stock water with fences.
- Fencing woodland for protection against grazing.
- Refraining from burning brush heaps in woodland.
- Practicing fire prevention and suppression for pasture, woodland, and wildlife areas.
- Planting trees for windbreaks in areas where the practice has been successful.
- Selecting tree and other vegetative species which produce food and cover for wildlife when planting windbreaks, hedges, field borders, gullies, etc.
- Fencing field and pasture boundaries to control the movement of livestock.
- Leveling hummocks and fence drifts formed by wind action.
- Fencing desilting plots above stock water.
- Practicing rodent control.

Spring

- Providing a home garden for family food supply.
- Improving old pastures with lime, fertilizer, disking and seeding.
- Using supplemental pastures in connection with native pastures and feed supplies.
- Establishing seed plots so as to have a supply of good home-grown seed.
- Providing proper maintenance of terraces and drainage systems.
- Seeding, maintaining and managing grass waterways in draws for hay and pasture.
- Sowing grasses and legumes in grain for increasing cover and late summer hay.
- Growing green manure crops for cover and fertility.
- Using interplanted crops for season cover.
- Improving the cropping system by the inclusion of grains, grasses, and legumes.
- Using rotations which permit established grass or legumes to remain for two or more years.
- Using rotations which include soil improving crops.
- Practicing plant disease control.
- Establishing strips for wind erosion (where practice has been successfully used; if a new practice in locality, should have technical assistance).
- Practicing contour tillage.
- Practicing shallow tillage to kill weeds and preserve moisture.
- Practicing rodent control.

Summer

- Mowing pastures to suppress weeds and encourage growth of desirable grasses.
- Building up and maintaining feed reserves to protect native grass pastures.
- Using supplemental pastures in connection with native pastures and feed supplies.
- Providing habitats which supply food and cover for wildlife.
- Practicing rodent control.
- Practicing insect control.
- Cultivating young tree plantings for weed control and conservation of moisture.
- Using rough cloddy tillage in wind erosion areas.
- Using lister, chisel, killifer, basin lister, or pit cultivator in low rainfall and wind erosion areas.
- Incorporating organic matter in soils.

Fall

- Provide a fall garden for family food supply.
- Growing winter grains after clean-tilled crops.
- Permitting a heavy crop residue to remain for cover.
- Protecting crop residues from fire and grazing.
- Using rotations which permit established grass or legumes to remain for 2 or more years.
- Using rotations which include soil-building crops (example: vetch, peas, etc.).
- Using the necessary fertilizers to condition the soil for crops to be grown.
- Using supplemental pastures in connection with native pastures and feed supplies.
- Building up and maintaining feed reserves to protect native grass pastures.
- Providing proper maintenance of terraces and drainage systems.
- Providing habitats which supply food and cover for wildlife.
- Leaving shocks of corn, grain, canes, etc., near field borders for winter feed for wildlife.
- Practicing fire prevention and suppression for pasture, woodland, and wildlife areas.
- Controlling hunting privileges.

(Signed) H. P. MOFFITT,
State USDA Defense Board.

COMING NEXT MONTH

"Selective Service for Each Acre," by
Glennon Loyd;
"Farm Conservation Planning for War
Needs," by E. H. Reed

DISTRICT AND SCHOOLS COOPERATE IN HANDLING EQUIPMENT

By FRED C. BURNS ¹

SUPERVISORS of the Fourche LaFave-Petit Jean Soil Conservation District in Yell County, Ark., and the vocational agricultural departments of seven consolidated high schools in the district have devised a plan for the most efficient use and proper maintenance of equipment granted to the district for erosion control work on farms cooperating in the soil conservation district program. Agreements signed by the supervisors and vocational agriculture instructors are proving profitable to both farmers and the agricultural departments.

Under the terms of this agreement, developed after careful study of several different methods, the supervisors of the district allocate certain pieces of equipment to the vocational agriculture instructors. The equipment is then to be rented to the land owners and cooperators in the respective school districts for developing erosion control measures on the farm lands in that community. Twenty-five percent of the money received from the farmers for the privilege of using the equipment is retained by the local Future Farmers of America chapter as compensation for their time and trouble in supervising the equipment. The remaining 75 percent collected is used for maintenance of the present equipment and for purchase of additional equipment.

The number of pieces and type of equipment, as well as the charges made for its use, was determined at a joint meeting of the board of supervisors, the county agricultural extension agent and the vocational agriculture instructors in the district. In determining the number of pieces of equipment allocated to any given vocational center, consideration was given to the number of soil conservation district agreements in the community, the needs and capabilities of the farmers in the community, and the efficiency with which the equipment could be used in the community.

In this plan the fees charged for the privilege of using the equipment are payable in advance and have been set high enough to assure proper maintenance and normal replacements. On the other hand, the payments are low enough that the farmers of the district can use the equipment economically. The charges vary, depending on the original cost, less normal de-

preciation, and the anticipated costs of upkeep. For example, should Jim Smith need a Kelly plow for constructing contour ridges or furrows on his farm he would be required to deposit 50 cents with the FFA chapter before taking the plow to his farm. This initial deposit would entitle Smith to the use of the plow for 5 full days. Should he keep the plow for 7 days he would be assessed an additional 20 cents when he returned the plow to the storage shop. If, however, Mr. Smith should complete his job before 5 days had passed and return the plow, he would be entitled to a refund of 10 cents per day for each day under the original 5 days for which he had paid. Instead, if Mr. Smith desired, he could be given credit in a like amount for further use of the plow in the future.

Again, if Mr. Smith wants to construct terraces on his farm, by depositing \$1 with the FFA chapter he may rent a terracer for 2 days with the privilege of using it as long as he needs it, provided he pays an additional 50 cents for each day he keeps the terracer over the original 2 days.

Other equipment available for erosion-control work on farms cooperating in the district program includes fresnos. A deposit of 75 cents is necessary and this entitles the farmer to the use of the fresno for 5 days. He agrees to pay an additional 15 cents for each day afterwards that the fresno is kept on the farm. Hill-side plows may be obtained for an initial deposit of 50 cents, and the farmer may keep the plow 5 days before any additional charges are made. Lespedeza combines require a deposit of \$1, and \$1 additional for each succeeding day that the combine is kept on the farm.

Before development of this plan for maintenance and supervision of the equipment granted to them, the supervisors of the Fourche LaFave-Petit Jean Soil Conservation District had tried several different methods with varying degrees of success. None had proved satisfactory, however, and as a result the equipment was in a bad state of repair and the outlook for new equipment was none too good. But with this latest plan the equipment is kept in an excellent state of repair and a reserve is being built up for purchase of new equipment. Too, a more efficient use is being made of the available equipment—when the farmer makes arrangements for renting a piece

¹ Assistant agronomist, Western Gulf Region, Soil Conservation Service, Danville, Ark.

of equipment, he has already made plans to use it immediately so that it may be returned as quickly as possible.

Today there is no idle equipment on the farms in the Fourche LaFave-Petit Jean Soil Conservation District.

The agreement as worked out by the supervisors of the Fourche LaFave-Petit Jean Soil Conservation District is presented below in its entirety:

Agreement between
FOURCHE LAFAVE-PETIT JEAN SOIL CONSERVATION DISTRICT
and
VOCATIONAL AGRICULTURAL DEPARTMENT, DARDANELLE SCHOOL
DISTRICT

Recognizing the close relationship between the programs of the Fourche LaFave-Petit Jean Soil Conservation District and Vocational Agriculture, and for the purpose of coordinating the efforts of the District and the Vocational Agriculture Instructors in controlling erosion on cooperating farms within the *Fourche LaFave-Petit Jean Soil Conservation District*, it is agreed that the Vocational Agriculture Department of *Dardanelle School District No. 15*, will furnish storage, and maintain and repair equipment and tools in-

cluded in the attached list, said list to become a part of this agreement.

It is further agreed that the vocational instructor charge a fee for the use of said equipment, the fees to be in accordance with the attached price schedule.

It is further agreed that the vocational instructor will retain twenty-five (25) percent of all fees collected (to revert to the treasury of the local Future Farmers of America Chapter) as compensation for his time and trouble in supervising the above equipment, and that he will use what is necessary of the remaining seventy-five (75) percent to assure proper maintenance of said equipment. All remaining monies shall revert to the Board of Supervisors of the Fourche LaFave-Petit Jean Soil Conservation District, who will be entitled to a report on the condition of the equipment and a financial statement semiannually.

This agreement may be terminated by mutual consent of the parties involved or by written notice by either partner, such notice to be given at least thirty (30) days before the date of effect.

VOCATIONAL AGRICULTURE DEPARTMENT
SCHOOL DISTRICT NO. 15,
By (S) HAROLD SNYDER,
Vocational Agriculture Instructor.
FOURCHE LAFAVE-PETIT JEAN
SOIL CONSERVATION DISTRICT,
By (S) DONALD BARGER,
Chairman, Board of Supervisors.

POOLING EFFORTS FOR SOIL CONSERVATION WORK

FARMERS and others are beginning to use their soil conservation districts to meet local erosion control problems effectively. The soil conservation job is enormous. Many different resources and many varied interests are at work. As an indication of an ever-increasing pooling of efforts, we here present a summary recently made by the Michigan State Soil Conservation Committee¹ of information supplied by each soil conservation district in that State of the sources and kinds of help being used by districts to carry on their work. The information was requested by the State Committee essentially so it would be in better position to help the districts most effectively. The summary, however, also indicates the possibilities through pooling of efforts necessary for localities and the Nation as a whole to meet the soil conservation problems.

Allegan Soil Conservation District.—Organized June 17, 1940. Includes approximately 200,000 acres of Allegan and Van Buren Counties. General fruit and truck farming on light, medium, and heavy soils. Severe wind erosion. Slight to severe water erosion. Agencies assisting and types of assistance are:

Fennville Future Farmers of America. Assisted

in preparing reconnaissance survey of district. Planted 5,000 evergreen seedlings. Helped set up office in Fruit Exchange Building in Fennville. Fennville Fruit Exchange. Furnished office space free of rent.

South Haven Future Farmers of America. Planted 10,000 evergreen seedlings.

Ganges Grange. Use of building for local meetings. Casco Township. Provided \$50 for fuel and office supplies.

Soil Conservation Service. Preliminary organization and survey work.

Extension Service. Educational work in connection with organization of the district.

West Ottawa Soil Conservation District. Explained working of their district.

State Department of Conservation. Supplied trees.

Fenton Soil Conservation District.—Organized November 10, 1939. Includes approximately 115,000 acres of Livingston and Genesee Counties. Dairy and general farming area. Rolling clay and sand. Slight to severe sheet erosion. Agencies assisting and types of assistance are:

Soil Conservation Service. Soil conservation plans prepared for 56 farms. Prepared farm woodlot plans for district cooperators.

¹ Members (names and titles): L. V. Card, commissioner of agriculture (chairman); P. J. Hoffmaster, director of the Michigan Department of Conservation; E. L. Anthony, dean of agriculture, Michigan State College.

State Department of Conservation. Prepared wildlife plans for 26 farms.

Farm Security Administration. Active assistance with district cooperators.

Extension Service. Conducted educational meetings and tours on soil conservation. Cooperated with district in distribution of TVA phosphate for demonstrational purposes.

Mason Soil Conservation District.—Organized January 20, 1941. Includes approximately 125,000 acres of Mason County. General farming and fruit area. Blowing sand and slight to severe sheet erosion on clay lands. Agencies assisting and types of assistance are:

Extension Service. Assisted in organizing district and carrying on educational program in connection with district activities.

Soil Conservation Service. Preparing soil conservation plans for district cooperators.

United States Forest Service. Counseled with district on preparation of forest planting plans for schools and other public lands.

State Department of Conservation. Furnished 15,000 seedlings for reforestation work on public lands.

Townships. Secured title to lands and entered into agreement with district as to use of land.

Public Schools. School forest projects being developed.

Grange. Will assist in reforesting public lands.

Farm Bureau. Will plant trees on public lands.

North Muskegon Soil Conservation District.—Organized September 29, 1939. Includes approximately 150,000 acres of Muskegon County. Heavy clay soils. Blowing sand in general farming area. National Forest holding within District boundaries. Agencies assisting and types of assistance are:

Montague Chamber of Commerce. Furnishes office space and heat.

Montague School. Sponsored soil conservation night school, 250 attendance. Miscellaneous office work. Has school forest of 650 acres.

Montague Vocational Agriculture. Made planting boards for nursery. Lined out 10,000 trees on nursery. Will conduct woodland management meetings. Trained boys for tree planting; these trained boys are available for hire for tree planting.

Townships and Rural Schools. Have acquired approximately 3,000 acres tax-delinquent lands and are cooperating with district in preparing long-time land-use plans for these areas. 200,000 trees have been planted to date.

School Commissioner. Arranging to have conservation taught in all public schools.

Farm Security Administration. Made loans to district cooperators to carry out soil and water conservation plans. Where necessary, made grants to cooperators. Grants to be worked out on public or district leased lands. Have insisted that new clients in district have land use plans made by district.

National Youth Administration. Made available NYA boys for office work and to assist in laying out field work, surveying forests, etc.

County Welfare. Furnished labor for district nursery.

United States Forest Service. Assisted in educational program. Prepared forest management plans for school property.

State Department of Conservation. Maintains fire towers. Organized fire control crews. Supplied 175,000 seedlings for school and township forests.

Bureau of Plant Industry. Eradicate Ribes on district cooperator farms where white pine is to be planted.

Extension Service. Conducted educational and other pertinent meetings in regard to district program. Secured TVA phosphate for demonstrational work in district. Assisted in securing tax-delinquent lands. Loaned money for purchase of seedling trees.

County Governing Body. Appropriated \$1,500 for fiscal year ended December 31, 1941.

Soil Conservation Service. Assisted directors in developing Program of Work. Planned 100 farms for soil conservation purposes. Supplied trees for erosion control work.

Work Projects Administration. Approved work project, no laborers yet available.

Auto Agency. Loaned tractor for nursery work. Put on demonstration on quackgrass control. Made transportation available for tour to visit Soil Conservation Service demonstration project.

St. Joe River Soil Conservation District.—Organized June 17, 1940. Includes approximately 58,000 acres of Berrien County. Intensive fruit area with slight to severe sheet erosion and occasional gullies. Very high value land. The following agencies have assisted or are willing to assist the district, according to the Secretary; no mention is made of type of assistance: County Highway Department, Co-ops, Grange, Senior Farm Bureau, Junior Farm Bureau, Vo-ag schools, Rural schools, newspapers, Extension Service, Banks,

Production Credit, AAA, Farm Loan Association, Farm Security Administration, Soil Conservation Service, Future Farmers, County Drain Commissioner, county and township governments.

Southeast Livingston Soil Conservation District.—Organized February 18, 1941. Includes approximately 69,000 acres of Livingston County. General and dairy farming. Developing program at present time.

South Muskegon Soil Conservation District.—Organized December 16, 1938. Includes approximately 140,000 acres of Muskegon County. Wind blown area of dry sands, muck lands and moraines. Soils adapted to fruit and general farming. Agencies assisting and types of assistance are:

Farm Security Administration. Loan to finance digging of 3,000 yards of marl. Loan to finance some nursery work. Loans to district cooperators. Made work grants to FSA clients when necessary, such grants to be worked out on public lands.

Forest Service. Furnished technical assistance on school forests.

State Department of Conservation. Furnishing seedlings for planting on public lands. Entered into cooperative agreement with district on use of Department-owned lands.

Work Projects Administration. Approved project for district, no laborers yet available.

County Highway Department. Loaned snow fence for use in district nursery. Cooperating on roadside erosion control work.

Public Schools. District assisted 33 schools in obtaining land for school forests. County school

commissioner is developing plan for teaching conservation in schools.

Local Relief Agency. Furnished available relief labor to work in district nursery.

Sheriff's Department. Furnished jail labor for work in nursery.

County Governing Body. Appropriated \$1,500 for district work.

National Youth Administration. Approved project making NYA assistance available for work on public lands.

Extension Service. Carried on educational program on soil conservation.

Soil Conservation Service. Prepared land use plans for district cooperators.

West Ottawa Soil Conservation District.—Organized May 9, 1938. Includes approximately 135,000 acres of Ottawa County. Wind eroded areas intermingled with general farming area. Stabilization of shifting sands and establishment of good land use program are major problems. Agencies assisting and types of assistance are:

County Governing Body. Appropriated \$1,000 for use of district.

Sheriff's Department. Labor for use in district nursery.

Rod and Gun Club. Furnished two cultivators and one seeder for district nursery.

Fish and Game Club. Growing trees and shrubs for the district.

West Olive Ladies' Club. Donated labor for weeding of district nursery.

(Continued on page 206)

AN AGRICULTURAL MOVEMENT MARCHES ON

Statistical Story of the Soil Conservation District Organization

By J. PHIL CAMPBELL ¹

IN A statement dated September 21, 1940, concerning departmental cooperation with soil conservation districts the Secretary of Agriculture said, "The speed with which land owners and operators all over the United States are organizing soil conservation

districts for a cooperative attack upon their problems of erosion control and soil conservation is one of the most remarkable developments in recent American agricultural history." The first soil conservation district in the United States was organized on August 4, 1937, and by December 15, 1941, slightly more than four years later, 653 districts, including about 382 million acres, had been established.

¹ Assistant Chief, Cooperative Relations and Information, Soil Conservation Service, Washington, D. C.

The Secretary also stated, "The philosophy of democratic government revolves around the principle that the mass of the people is capable of governing. It is my conviction that a democracy, therefore, cannot be said to be succeeding unless the mass of the people participates in the affairs of government. Only their participation makes a democracy work. The distinguishing characteristic of the soil conservation districts' legislation is that this principle is uppermost; these State soil conservation districts laws place the responsibility for the management of a soil conservation district upon local folk. We in the Department welcome the opportunity to work in the closest

cooperation with these districts that the farmer themselves are forming and managing." [*Italics words supplied.*]

Realizing that many people are interested in the development of the soil conservation districts movement, the Secretary requested the Soil Conservation Service to issue periodically a statement summarizing the available information with reference to the number, location, and stage of organization of soil conservation districts throughout the country. Here is currently assembled information summarized for the convenience of those to whom it is not regularly available.

TABLE 1.—Organization of soil conservation districts to Dec. 15, 1941

Name of State	Petitions accepted	Determination made as to need		Referendum held	Determination made as to operation		Certificate of organization issued ¹	Governing body organized
		Needed	Not needed		Practical and feasible	Not practical and feasible		
Alabama.....	12	12	0	12	12	0	12	12
Arizona.....	9	9	0					
Arkansas.....	61	38	3	38	37	0	36	36
California.....	16	13	0	13	13	0	13	13
Colorado.....	33	33	0	32	22	6	22	22
Florida.....	16	13	2	12	11	0	10	10
Georgia.....	28	21	0	21	19	1	19	19
Idaho.....	17	12	0	12	10	2	9	9
Illinois.....	16	14	0	13	12	1	10	9
Indiana.....	23	17	5	17	12	5	12	12
Iowa.....	23	19	0	18	17	1	17	17
Kansas.....	65	44	9	43	16	26	16	16
Kentucky.....	23	21	1	19	17	2	16	14
Louisiana.....	36	13	0	13	13	0	13	13
Maine.....	3	3	0					
Maryland.....	12	11	0	11	11	0	8	8
Michigan.....	10	10	0	10	9	1	9	9
Minnesota.....	13	13	0	12	12	0	12	12
Mississippi.....	42	37	4	34	34	0	33	30
Montana.....	11	10	0	9	8	1	8	8
Nebraska.....	46	40	6	40	34	6	32	31
Nevada.....	8	8	0	8	8	0	7	7
New Jersey.....	5	5	0	4	4	0	4	4
New Mexico.....	44	37	4	34	29	1	22	19
New York.....					11	0	11	10
North Carolina.....	19	18	0	18	14	0	13	13
North Dakota.....	17	15	0	15	15	0	15	15
Oklahoma.....	93	76	12	76	57	18	56	52
Oregon.....	11	9	2	7	6	0	6	6
Pennsylvania.....	17	10	1	10	4	1	4	4
South Carolina.....	13	13	0	13	13	0	12	12
South Dakota.....	29	26	3	24	24	0	23	23
Tennessee.....	19	16	1	16	16	0	16	14
Texas ²	108	99	9	94	79	12	73	73
Utah.....	38	28	2	26	23	2	20	19
Vermont.....	4	4	0	4	4	0	4	4
Virginia.....	14	14	0	13	13	0	13	13
Washington.....	19	18	0	18	15	3	14	12
West Virginia.....	19	13	0	11	6	5	6	5
Wisconsin.....					27	0	27	27
Wyoming.....	7	4	0	4	4	0		
Totals.....	999	816	64	774	691	94	653	632

¹ By provisions of most State soil conservation districts laws, a district is created when the certificate of organization has been recorded. See table 2 for names, approximate acreages, and generalized boundary descriptions of districts organized.

² Includes 8 county wind erosion conservation districts.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941

State	Name of District	See Note for symbols	Approximate acreage	Approximate number ¹		General location
				Operating units	Farms	
Alabama.....	Piedmont.....	Ma	Thousands 2, 070	8, 319	13, 878	Chambers, Clay, Coosa, Randolph, and Tallapoosa Counties.
	Central Alabama.....	Ma	2, 548	15, 115	19, 257	Autauga, Dallas, Lowndes, Montgomery, and Wilcox Counties.
	Tombigbee-Warrior.....	Ma	3, 603	15, 748	24, 606	Fayette, Lamar, Marion, Walker, Winston, Tuscaloosa, and Pickens Counties.
	Conecuh River.....	Ma	3, 354	13, 683	19, 367	Butler, Conecuh, Monroe, Covington, Crenshaw, and Escambia Counties.
	Black Belt.....	Ma	2, 491	10, 609	20, 186	Green, Hale, Marengo, Perry and Sumter Counties.
	Coosa River.....	Ma	2, 371	9, 399	16, 719	Calhoun, Cherokee, Etowah, St. Clair, Cleburne, and Talladega Counties.
	Wiregrass.....	Ma	2, 323	11, 115	19, 468	Coffee, Dale, Geneva, Henry, Pike, and Houston Counties.
	East Alabama.....	Ma	2, 581	8, 786	18, 139	Lee, Barbour, Bullock, Elmore, Macon, and Russell Counties.
	North Central.....	Ma	3, 007	16, 480	23, 454	Bibb, Blount, Chilton, Cullman, Jefferson, and Shelby Counties.
	Mobile River.....	Ma	3, 876	10, 767	13, 043	Baldwin, Choctaw, Clarke, Mobile, and Washington Counties.
	Northwest Alabama.....	M	2, 077	9, 744	16, 961	Colbert, Franklin, Lawrence, Lauderdale, and Morgan Counties.
	Northeast Alabama.....	M	2, 518	15, 539	26, 668	DeKalb, Jackson, Limestone, Madison, and Marshall Counties.
Total.....	12.....	-----	32, 819	.....	.....	
Arkansas.....	Mine Creek.....	Ma	167	890	1, 299	Part of Howard and Pike Counties.
	Magazine.....	Ma	223	3, 206	3, 209	Part of Logan, Scott, and Sebastian Counties.
	G. C. C. R.....	Ma	307	2, 630	2, 854	Part of Greene and Clay Counties.
	East Central Arkansas.....	Ma	1, 085	8, 338	9, 456	Part of White, Lonoke, Pulaski, Faulkner, and Cleburne Counties.
	Poteau River.....	Ma	423	1, 587	1, 670	Part of Scott and Sebastian Counties.
	Tri-River.....	Ma	720	5, 222	5, 528	Part of Lawrence and Randolph Counties.
	Lower East Saline.....	Ma	489	2, 310	2, 607	Part of Lincoln, Drew, and Ashley Counties.
	Illinois Bayou.....	Ma	233	1, 110	1, 258	Part of Pope County.
	Crooked Creek.....	Ma	660	2, 874	3, 084	Part of Marion, Boone, Searcy, and Newton Counties.
	Central Valleys.....	Ma	1, 315	6, 692	7, 055	Part of Faulkner, Cleburne, Van Buren, Conway, and Pope Counties.
	South Crowley Ridge.....	Ma	397	3, 264	4, 883	Part of Lee, St. Francis and Cross Counties.
	Terre Rouge-Bodcaw.....	Ma	1, 020	7, 153	7, 827	Part of Hempstead, Nevada, and Lafayette Counties.
	Central Crowley's Ridge...	Ma	168	3, 038	4, 541	Part of Craighead and Poinsett Counties.
	Fourche LaFave-Petit Jean...	Ma	628	2, 380	2, 480	Yell County; part of Perry County.
	King's River-Long Creek...	Ma	490	2, 582	2, 813	Part of Boone and Carroll Counties.
	Moorefield.....	Ma	684	3, 870	4, 526	Part of Independence, Lawrence and Sharp Counties.
	L'Aigle Creek.....	Ma	466	1, 580	1, 650	Bradley County; part of Cleveland County.
	West Saline.....	Ma	342	1, 250	1, 538	Part of Cleveland County.
	Mulberry-Piney.....	Ma	373	2, 590	2, 701	Part of Franklin and Johnson Counties.
	Strawberry River.....	Ma	635	3, 183	3, 902	Izard County; part of Sharp County.
	Ouachita.....	Ma	469	1, 850	1, 952	Ouachita County.
	Cossatot.....	Ma	366	1, 634	1, 648	Sevier County.
	Washington County.....	Ma	611	1, 250	1, 348	Washington County.
	Spring River.....	Ma	528	2, 325	2, 575	Fulton County; part of Sharp County.
	Benton County.....	Ma	561	4, 180	5, 570	Benton County.
	Madison County.....	M	177	850	954	Part of Madison County.
	Des Arc.....		195	910	949	Part of Prairie County.

¹ Data are tentative and not yet available for all districts. Estimates based on 1940 census as primary source using census definition of a "farm," with the concept of "operating unit" described as follows: An "operating unit" is a tract of land (or 2 or more adjacent or nearby tracts of land), whether or not under a single ownership, operated by 1 person as a unit as to crop or grazing rotation practices, and with work stock, machinery, and labor substantially separate from that for any other land.

NOTE.—"M" Basic Memorandum of Understanding with U. S. D. A.

"a" Assistance from Soil Conservation Service through Memorandum of Understanding.

"b" Assistance from Forest Service through Memorandum of Understanding (Shelter Belt Area).

(WED) Texas County Wind Erosion Conservation Districts.

* Districts established since last report.

** Additional territory included since last report.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Arkansas.....	Little River.....	M	Thousands 349	1, 650	1, 960	Little River County.
	Blue Mountain.....		391	1, 302	1, 602	Stone County.
	Dorcheat.....	Ma	455	3, 580	3, 700	Part of Columbia County.
	Lake Hamilton.....		472	1, 305	1, 573	Garland County.
	Crystal Mountain.....		502	1, 280	1, 341	Montgomery County.
	Hightower.....		400	1, 605	1, 712	Parts of Baxter and Marion Counties.
	Rich Mountain.....		541	1, 902	1, 975	Polk County.
	Little Missouri.....		375	1, 276	1, 283	Part of Pike County.
	Buffalo.....		440	1, 809	2, 071	Parts of Searcy and Baxter Counties.
Total.....	36.....		17, 657			
California.....	San Mateo County.....	Ma	17	120	120	Part of San Mateo County.
	Central El Dorado.....	Ma	32	300	300	Part of El Dorado County.
	San Marcos-Richland-Twin Oaks.....	Ma	13	101	120	Part of San Diego County.
	Gold Ridge.....	M	99	1, 725	1, 725	Part of Sonoma County.
	Moreno-Campo-Potrero.....	Ma	140	3	85	Part of San Diego County.
	Simi Valley.....	Ma	83	302	437	Part of Ventura County.
	Portal Ridge.....	Ma	47	500	320	Part of Los Angeles County.
	Mira Loma.....		6	60	60	Part of Riverside County.
	Valley Center.....	M	18	225	0	Part of San Diego County.
	Cucamonga-Mountain View.*.....		24	308	308	Part of San Bernardino County.
	Mission-Soledad*.....		38	98	98	Part of Monterey County.
	Scotts Valley-Upper Lake*.....		80	260	136	Part of Central Lake County.
	Contra Costa*.....		176	1, 100	700	Part of Contra Costa County.
Total.....	13.....		773			
Colorado.....	Great Divide.....	Ma	376	113	113	Part of Moffat County.
	Western Baca County.....	Ma	853			Part of Baca County.
	Southeastern Baca County.....	Ma	391			Part of Baca County.
	Plainview.....	Ma	152			Part of Kit Carson County.
	Smoky Hill.....	Ma	150			Part of Kit Carson County.
	Big Sandy.....	Ma	155			Part of Elbert County.
	Horse and Rush Creek.....	Ma	239			Part of Elbert County.
	Orchard Mesa.....	Ma	35	325	383	Part of Mesa County.
	West Plum Creek.....	Ma	104			Part of Douglas County.
	Vernal Mesa.....	Ma	42	33	53	Part of Montrose County.
	Custer County Divide.....	Ma	110			Part of Custer County.
	Upper Huerfano.....	Ma	487			Part of Huerfano County.
	Kannah Creek.....	Ma	145	37	37	Part of Mesa County.
	Glade Park.....	Ma	265	230	230	Part of Mesa County.
	Cheyenne.....	Ma	166			Part of Cheyenne County.
	Agate.....	Ma	275			Part of Elbert County.
	Redlands.....	Ma	15	190	257	Part of Mesa County.
	Shavano.....		21			Part of Montrose County.
	Pueblo.....		904			Part of Pueblo County.
	Kiowa.....		114			Part of Elbert and Douglas Counties.
	Stonewall.....		318			Part of Las Animas and Costilla Counties.
	Two Buttes*.....		88	115	316	Part of Baca County.
Total.....	22.....		5, 406			
Florida.....	Holmes Creek.....	Ma	250	1, 173	1, 541	Part of Jackson and Holmes Counties.
	Perdido River.....	Ma	366	1, 021	1, 164	Escambia County.
	Choctawhatchee River.....	Ma	836	1, 328	1, 697	Walton Co.; part of Holmes County.
	Orange Hill.....	Ma	469	1, 023	1, 259	Washington County.
	Chipola River.....	Ma	1, 100	2, 750	3, 358	Part of Jackson and Calhoun Counties.
	Ochlocknee River.....	Ma	458	1, 080	1, 443	Leon County.
	Jefferson.....	Ma	377	1, 060	1, 288	Jefferson County.
	Yellow River.....	Ma	377	429	539	Part of Okaloosa County.
	Gadsden.....	Ma	346	1, 131	1, 466	Gadsden County.
	Madison.....	M	460	1, 252	1, 499	Madison County.
Total.....	10.....		5, 039			

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Georgia.....	Coosa River.....	Ma	Thousands 1,982	9,093	15,777	Bartow, Floyd, Polk, Chattooga, Gordon, Paulding, Walker, and Cobb Counties.
	Broad River.....	Ma	1,622	6,468	13,831	Banks, Stephens, Franklin, Madison, Hart, Wilkes, Oglethorpe, and Elbert Counties.
	Upper Chattahoochee River.....	Ma	1,098	4,839	8,179	Habersham, White, Lumpkin, Hall, Dawson, and Forsyth Counties.
	Middle Western Ocmulgee River.....	Ma	1,887	5,845	9,526	Wilcox, Pulaski, Dooly, Peach, Houston, Crawford, Macon, Taylor, and Bibb Counties.
	Piedmont.....	Ma	1,660	3,914	7,534	Baldwin, Greene, Hancock, Putnam, Taliaferro, Morgan, and Jones Counties.
	Oconee River.....	Ma	527	2,620	5,362	Jackson, Barrow, Oconee, and Clarke Counties.
	Upper Ocmulgee River.....	Ma	1,246	5,917	11,320	Newton, Walton, Rockdale, Henry, Gwinnett, Clayton, and Jasper Counties; part of Dekalb County.
	West Georgia.....	Ma	812	4,654	8,465	Carroll, Douglas, Haralson, and Heard Counties.
	Little River.....	Ma	224	491	1,200	Columbia County.
	Briar Creek.....	Ma	1,247	2,511	5,717	Richmond, Burke, Jefferson, and Glascock Counties.
	Middle South Georgia.....	Ma	1,303	4,857	9,041	Ben Hill, Tift, Irwin, Crisp, Turner, and Worth Counties.
	Limestone Valley.....	Ma	826	3,089	5,009	Gilmer, Murray, Whitfield, and Pickens Counties.
	Ohoopce River.....	Ma	1,030	3,321	5,949	Treutlen, Emanuel, Montgomery, and Toombs Counties.
	Pine Mountain.....	Ma	1,358	3,229	5,498	Meriwether, Harris, Talbot, Chattahoochee, Muscogee, and Marion Counties.
	Lower Chattahoochee River.....	Ma	1,707	4,823	10,109	Schley, Terrell, Quitman, Sumter, Webster, Clay, Lee, Stewart, and Randolph Counties.
	Flint River.....	Ma	2,288	8,035	14,086	Baker, Seminole, Mitchell, Grady, Decatur, Early Miller, Calhoun, and Dougherty Counties.
	Central Georgia.....	Ma	1,151	3,378	6,198	Wilkinson, Washington, Twiggs, and Johnson Counties.
	Towaliga.....	Ma	705	2,221	3,934	Pike, Monroe, Spalding, and Butts Counties.
	Ogeechee River.....	Ma	428	1,591	2,842	Bulloch County.
	Total.....	19.....	23,101	.....	.....	.....
Idaho.....	Latah.....	Ma	694	1,550	2,125	Latah County.
	Bear Lake.....	Ma	661	650	800	Bear Lake County.
	Mayfield.....	Ma	408	56	81	Part of Elmore and Ada Counties.
	Portneuf.....	Ma	1,170	1,800	2,200	Bannock County.
	Squaw Creek.....	Ma	300	200	260	Part of Gem and Boise Counties.
	Kootenai.....	M	829	1,600	2,011	Kootenai County.
	Oneida.....	.....	776	700	935	Oneida County.
	Lewis.....	.....	293	525	692	Lewis County.
	Nez Perce.....	.....	525	901	1,282	Nez Perce County.
	Total.....	9.....	5,656	.....	.....	.....
Illinois.....	Shiloh-O'Fallon.....	Ma	212	2,050	2,343	Part of St. Clair County.
	Munson.....	Ma	40	207	225	Part of Henry County.
	Whitehall-Roodhouse.....	Ma	80	437	515	Part of Greene County.
	R. C. L. W.....	Ma	80	475	645	Part of Richland, Crawford, Lawrence, and Wabash Counties.
	Pecatonica-Durand.....	Ma	65	403	447	Part of Winnebago and Stephenson Counties.
	Montgomery County.....	Ma	87	540	600	Part of Montgomery County.
	Jo Daviess County.....	Ma	154	937	967	Part of Jo Daviess County.
	Elmwood.....	Ma	158	885	950	Part of Peoria County.
	Johnson County.....	Ma	212	1,415	1,506	Part of Johnson County.
	Carroll County.....	.....	85	474	509	Part of Carroll County.
	Total.....	10.....	1,173	.....	.....	.....
Indiana.....	Southwestern Indiana.....	Ma	84	1,300	1,530	Part of Vanderburgh County.
	Knox County.....	Ma	323	2,625	2,847	Knox County.
	Prairie.....	Ma	38	189	225	Part of Benton and Warren Counties.
	Akron.....	Ma	31	335	362	Part of Fulton County.
	Grant County.....	Ma	81	878	965	Part of Grant County.
	Coal Creek.....	Ma	35	276	333	Part of Montgomery County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Indiana	Daviess County	Ma	211	2, 461	2, 734	Part of Daviess County.
	Tippecanoe		27	123	166	Part of Tippecanoe County.
	Elkhart County	Ma	59	608	618	Part of Elkhart County.
	Noble	M	22	194	204	Part of Noble County.
	Newton	Ma	165	675	700	Part of Newton County.
	Greene-Clay-Owen	Ma	35	371	433	Part of Greene, Clay, and Owen Counties.
Total	12		1, 111			
Iowa	Marion County	Ma	35	2, 302	2, 513	Part of Marion County.
	Montgomery	Ma	271	1, 504	1, 633	Montgomery County.
	Clayton County	Ma	106	680	706	Part of Clayton County.
	Lucas County	Ma	264	1, 493	1, 796	Lucas County.
	Adair County	Ma	359	1, 942	2, 098	Adair County.
	Soldier-Maple Valley	Ma	270	1, 320	1, 579	Part of Monona County.
	Van Buren County	Ma	296	1, 883	2, 057	Van Buren County.
	Taylor County	Ma	338	2, 208	2, 208	Taylor County.
	Mills County	Ma	265	1, 356	1, 500	Mills County.
	Jefferson County		263	1, 662	1, 782	Jefferson County
	Crawford County	Ma	447	2, 500	2, 800	Crawford County.
	Linn County	M	211	1, 848	1, 906	Part of Linn County.
	Winneshiek County	M	427	2, 598	2, 887	Winneshiek County.
	Wapello County	M	258	1, 884	2, 008	Wapello County.
	Fremont County	Ma	311	1, 670	1, 742	Fremont County.
	Page County		331	2, 225	2, 365	Page County.
	Wayne County		317	1, 966	2, 112	Wayne County.
Total	17		4, 769			
Kansas	Labette County	Ma	412		2, 464	Labette County.
	Lyon County	Ma	546		2, 406	Lyon County.
	Osage County	Ma	460		2, 309	Osage County.
	Pawnee County	Mab	475		1, 102	Pawnee County.
	Wilson County	Ma	372		1, 856	Wilson County.
	Coffey County	Ma	412		1, 956	Coffey County.
	Brown County	Ma	365		2, 034	Brown County.
	Allen County	Ma	325		1, 949	Allen County.
	Geary County	Ma	250		687	Geary County.
	Morris County	Mab	445		1, 414	Morris County.
	Grant County	Ma	370		272	Grant County.
	Marshall County	Ma	579		2, 686	Marshall County.
	Ness County	M	691		1, 059	Ness County.
	Franklin County	Ma	374		2, 153	Franklin County
	Doniphan County	M	242		1, 670	Doniphan County.
	Trego County		575		884	Trego County.
Total	16		6, 893			
Kentucky	South Logan	Ma	195	1, 574	1, 736	Part of Logan County.
	Garrard County	Ma	148	1, 479	1, 922	Garrard County.
	Pendleton	Ma	177	1, 556	1, 741	Pendleton County.
	Union County	Ma	216	1, 200	1, 217	Union County.
	McCracken County	Ma	153	1, 780	1, 937	McCracken County.
	Marion County	Ma	218	1, 566	2, 122	Marion County.
	Graves County	Ma	354	4, 095	4, 247	Graves County.
	Carlisle County	Ma	124	1, 183	1, 143	Carlisle County.
	Gallatin	Ma	63	492	729	Gallatin County.
	Grant	Ma	158	1, 534	1, 545	Grant County.
	Tradewater	Ma	92	637	687	Part of Christian, Caldwell, and Hopkins Counties.
	Christian County	Ma	418	2, 292	2, 685	Part of Christian County.
	Hickman County	M	157	1, 301	1, 338	Hickman County.
	Richland Creek	Ma	47	567	824	Part of Knox County.
	Scott County		180	929	1, 617	Scott County.
	Fleming County		222	1, 820	2, 433	Fleming County.
Total	16		2, 922			

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Louisiana	Feliciana	Ma	Thousands 830	3, 509	4, 775	East Feliciana and West Feliciana Parishes; part of East Baton Rouge and St. Helena Parishes.
	Upper Sabine	Ma	935	4, 025	5, 113	Part of Caddo, De Soto, Sabine and Vernon Parishes.
	D'Arbonne	Ma	1, 179	6, 578	8, 168	Union Parish; Part of Claiborne, Lincoln, Jackson, and Ouachita Parishes.
	Upper West Red River	Ma	803	6, 589	8, 215	Part of Caddo, De Soto, Red River, Natchitoches, and Sabine Parishes.
	Saline	Ma	901	5, 321	6, 188	Part of Claiborne, Bienville, Webster, Winn, Red River, and Natchitoches Parishes.
	Dorcheat	Ma	961	5, 985	7, 097	Bossier Parish; part of Webster, Claiborne, Bienville, and Red River Parishes.
	Bogue Chitto-Pearl River	Ma	968	4, 498	6, 519	Washington Parish; part of St. Tammany, Tangipahoa, and St. Helena Parishes.
	Dugdemonia	Ma	1, 213	4, 537	5, 219	Part of Lincoln, Bienville, Caldwell, Grant, La Salle, Winn, and Jackson Parishes.
	Calcasieu	Ma	1, 500	4, 999	5, 304	Beauregard Parish; part of Allen, Vernon, and Rapides Parishes.
	Lower East Red River	Ma	1, 300	4, 200	5, 398	Grant Parish; part of Winn, La Salle, Catahoula, and Rapides Parishes.
	Grand Coteau Ridge	Ma	268	4, 391	6, 005	Part of Evangeline, St. Landry, and St. Martin Parishes.
	Lower West Red	Ma	800	2, 832	2, 952	Part of Natchitoches and Rapides Parishes.
	Northeast		771	4, 564	6, 868	Morehouse County; part of West Carroll, Richland, Franklin, and Catahoula Counties.
Total	13		12, 429			
Maryland	Kent	Ma	180	740	852	Kent County.
	Catoctin	Ma	90	792	850	Part of Frederick County.
	Gunpowder Falls—Deer Creek	Ma	667	5, 000	5, 391	Harford and Baltimore Counties.
	Monocacy	Ma	487	4, 000	4, 163	Part of Frederick and Carroll Counties.
	Washington County	Ma	309	2, 290	2, 516	Washington County.
	Charles	Ma	297	1, 311	1, 276	Charles County.
	Prince Georges	Ma	308	1, 711	2, 158	Prince Georges County.
	Allegany		265	860	900	Allegany County.
Total	8		2, 603			
Michigan	West Ottawa	Ma	135	1, 040	1, 400	Part of Ottawa County.
	South Muskegon	Ma	140	993	1, 840	Part of Muskegon County.
	North Muskegon	Ma	150	550	1, 500	Part of Muskegon County.
	Fenton	Ma	115	1, 063	1, 047	Part of Livingston and Genesee Counties.
	St. Joe River	Ma	58	1, 023	1, 193	Part of Berrien County.
	Mason County	Ma	115	450	1, 258	Part of Mason County.
	Allegan	Ma	200	2, 600	3, 300	Part of Allegan and Van Buren Counties.
	Southeast Livingston	Ma	69	469	461	Part of Livingston County.
	Grand Traverse	Ma	298	1, 000	1, 614	Part of Grand Traverse County.
Total	9		1, 280			
Minnesota	Burns-Homer-Pleasant	Ma	54	304	320	Part of Winona County.
	Rollingstone, Stockton, and Gilmore Creek	Ma	92	430	450	Part of Wabasha and Winona Counties.
	Root River	Ma	406	2, 214	2, 488	Part of Houston and Winona Counties.
	East Fillmore	Ma	276	1, 820	1, 800	Part of Fillmore County.
	East Goodhue	Ma	143	825	918	Part of Goodhue County.
	Upper Zumbro	Ma	250	1, 644	1, 855	Part of Dodge and Olmsted Counties.
	Dakhue	Ma	223	1, 526	1, 628	Part of Dakota and Goodhue Counties.
	Whitewater	M	168	890	940	Part of Winona County.
	Lake Pepin	M	180	870	934	Part of Wabasha County.
	Scott County		215	1, 679	1, 755	Scott County.
	East Agassiz		251	884	1, 140	Part of Polk, Norman, and Clay Counties.
	Washington County		223	1, 823	2, 220	Washington County.
Total	12		2, 481			

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Mississippi	Kemper County	Ma	Thousands 481	2, 100	3, 482	Kemper County.
	Clarke County	Ma	432	1, 936	2, 525	Clarke County.
	Covington County	Ma	262	1, 762	2, 609	Covington County.
	Lauderdale County	Ma	448	2, 038	2, 844	Lauderdale County.
	Claiborne County	Ma	313	672	1, 800	Claiborne County.
	Franklin County	Ma	350	1, 102	1, 691	Franklin County.
	Madison County	Ma	464	2, 173	5, 538	Madison County.
	Winston County	Ma	382	2, 131	3, 380	Winston County.
	Leake County	Ma	369	2, 566	4, 205	Leake County.
	Copiah County	Ma	492	2, 724	4, 526	Copiah County.
	Tallahatchie River	Ma	1, 000	5, 257	11, 575	Part of Panola, Marshall, Benton, Tippah, Union, Pontotoc, Lafayette, and Tate Counties.
	Smith County	Ma	401	2, 144	3, 289	Smith County.
	Lowndes County	Ma	319	1, 924	3, 330	Lowndes County.
	Simpson County	Ma	368	2, 149	3, 369	Simpson County.
	Neshoba County	Ma	359	2, 645	4, 384	Neshoba County.
	Holmes County	Ma	481	2, 032	6, 350	Holmes County.
	Jones County	Ma	445	3, 009	3, 951	Jones County.
	Northeast Mississippi	Ma	1, 923	10, 385	20, 751	Lee, Itawamba, Tishomingo, Alcorn, Prentiss, Pontotoc; part of Union, Tippah, Benton, and Lafayette Counties.
	Wayne County	Ma	520	1, 583	2, 162	Wayne County.
	Hinds County	Ma	535	2, 543	6, 396	Hinds County.
	Tate County	Ma	256	1, 104	3, 532	Part of Tate County.
	Calhoun County	Ma	371	1, 688	3, 237	Calhoun County.
	Newton County	Ma	363	2, 343	3, 483	Newton County.
	Adams County	Ma	273	949	1, 641	Adams County.
	Montgomery County	Ma	255	1, 090	2, 275	Montgomery County.
	Yalobusha County	Ma	314	1, 321	2, 928	Yalobusha County.
	Noxubee County		436			Noxubee County.
	Webster County		266			Webster County.
	Jasper County		427			Jasper County.
	Marshall County		277			Part of Marshall County.
	Three Rivers		1, 170			Greene, George, and Perry Counties.
	Rankin County*		506	2, 595	3, 605	Rankin County.
	Warren County*		366	1, 266	2, 310	Warren County.
Total	33		15, 624			
Montana	Wibaux	Ma	565	373	1, 000	Wibaux County.
	Reserve	Ma	1, 070	1, 238	1, 800	Sheridan County.
	Mona-Andes	Ma	340	191	500	Part of Richland County.
	Culbertson-Bainville	Ma	143	174	350	Part of Roosevelt County.
	Froid	Ma	131	193	275	Do.
	Box Elder	M	700	198	600	Part of Carter County.
	Bitter Root		180	60	150	Part of Missoula and Ravalli Counties.
	Green Mountain		122	64	100	Part of Sanders County.
Total	8		3, 251			
Nebraska	Papio	Ma	114	811	850	Part of Washington County.
	Plum-Beaver	Mab	142	545	733	Part of Boone, Nance, and Platte Counties.
	Turkey Creek	Ma	198	1, 144	1, 262	Part of Pawnee, Johnson, and Gage Counties.
	Shell Creek	Mab	110	781	948	Part of Madison and Platte Counties.
	Cedar River	Mab	129	384	459	Part of Wheeler, Greeley, and Boone Counties.
	Thayer County	Ma	130	551	631	Part of Thayer County.
	Douglas	Ma	84	550	550	Part of Douglas County.
	West Richardson	Ma	71	384	441	Part of Richardson and Pawnee Counties.
	Cass	Ma	68	337	439	Part of Cass County.
	Union Creek	Mab	77	350	480	Part of Madison and Stanton Counties.
	Stanton	Mab	61	350	357	Part of Stanton County.
	Morrill County	Ma	881	1, 050	1, 691	Part of Morrill County.
	Wayne County	Mab	80	416	427	Part of Wayne County.
	Beaver-Sappa	Ma	180	759	812	Part of Furnas County.
	Deuel County	Ma	281	515	544	Deuel County.
	Harlan County	Ma	98	248	426	Part of Harlan County.
	Sugarloaf	Ma	225	55	64	Part of Dawes and Sioux Counties.
	Howard County	Mab	66	330	436	Part of Howard County.
	Antelope	Mab	68	293	384	Part of Antelope County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Nebraska	First Commissioner	Mab	154	590	756	Part of Scotts Bluff County.
	Franklin County	Mab	88	273	336	Part of Franklin County.
	Buffalo-Ravenna	Mab	134	510	625	Part of Buffalo County.
	Palisade		502	600	680	Part of Hitchcock and Hayes Counties.
	Lancaster	Ma	47	217	428	Part of Lancaster County.
	Chaeo		181	821	840	Part of Furnas County.
	Nemaha		64	386	459	Part of Nemaha County.
	Red Willow County	Mab	455	1,302	1,581	Red Willow County.
	New Helena	Mab	618	1,650	1,700	Part of Custer County.
	Otoe	M	88	476	520	Part of Otoe County.
	Nance County		175	652	1,028	Part of Nance County.
	Pine Ridge		102	81	93	Part of Dawes County.
	Thurston*		155			Part of Thurston County.
Total	32		5,826			
Nevada	Moapa	Ma	461	80	104	Part of Clark County.
	Virgin Valley	Ma	207	95	114	Part of Clark County.
	Smith Valley	Ma	230	82	101	Part of Douglas and Lyon Counties.
	Pahranagat Valley	Ma	1,888	44	56	Part of Lincoln County.
	Meadow Valley	Ma	2,638	81	105	Part of Lincoln County.
	Mason Valley	Ma	622	139	149	Part of Lyon and Mineral Counties.
	Carson Valley	Ma	377	134	179	Part of Douglas County.
Total	7		6,423			
New Jersey	Freehold	Ma	698	3,630	4,858	Mercer, Middlesex, and Monmouth Counties.
	Camburton**	Ma	1,153	2,450	3,481	Burlington, Ocean, and Camden Counties.
	Morris-Warren**	Ma	542	1,900	2,700	Warren and Morris Counties; part of Sussex County.
	South Jersey	Ma	650	4,000	4,525	Gloucester and Cumberland Counties.
Total	4		3,043			
New Mexico	Mesa	Ma	571			Part of Harding, San Miguel, Colfax, and Union Counties.
	Northeastern	Ma	439			Part of Union County.
	De Baca County	Ma	1,200	298	303	Part of De Baca County.
	Central Curry	Ma	897		1,191	Curry County.
	Canadian River	Ma	790			Part of Quay County.
	Southwest Quay	Ma	402			Part of Quay County.
	Otero	Ma	2,443	797	797	Part of Otero County.
	Guadalupe	Ma	1,622	320	320	Part of Guadalupe County.
	Roosevelt	Ma	933			Part of Roosevelt County.
	Border	Ma	1,143			Part of Chaves and Roosevelt Counties.
	Claunich-Pinto		500	208	208	Parts of Socorro, Torrance, and Lincoln Counties.
	Sedillo		150	206	235	Part of Bernalillo County.
	Ute Creek		750			Part of Harding, Union, and San Miguel Counties.
	Western Mora		325	2,000	2,000	Part of Mora County.
	Macho	Ma	600	60	64	Part of Chaves and Lincoln Counties.
	Penasco	Ma	1,112			Part of Chaves and Eddy Counties.
	Upper Hondo	M	700			Part of Lincoln County.
	Edgewood		500			Part of Santa Fe County.
	Mora-San Miguel		1,275			Part of Mora and San Miguel Counties.
	Caballo		600			Part of Sierra, Luna, and Dona Ana Counties.
	San Juan		160			Part of San Juan County.
	Eastern Taos		1,000			Part of Taos County.
Total	22		18,112			
New York	Schoharie County	Ma	411	1,520	2,453	Schoharie County.
	Yates County	Ma	220	1,235	1,548	Yates County.
	Schuyler County	Ma	215	900	1,126	Schuyler County.
	Chenango County	Ma	572	1,980	3,371	Chenango County.
	Wyoming County	Ma	385	1,890	2,616	Wyoming County.
	Madison County	Ma	416	2,308	2,752	Madison County.
	Oneida County	Ma	800	3,760	4,706	Oneida County.
	Ontario County	Ma	415	2,200	3,093	Ontario County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
New York	Seneca County	Ma	215	1, 180	1, 413	Seneca County.
	Cattaraugus County	Ma	860	3, 312	4, 124	Cattaraugus County.
	Allegany County*		671	1, 914	3, 018	Allegany County.
	Total	11	5, 180			
North Carolina	Brown Creek	Ma	1, 370	5, 848	9, 950	Anson, Montgomery, Richmond, and Union Counties.
	Fishing Creek	Ma	705	3, 713	6, 110	Warren and Halifax Counties.
	Tri-Creek	Ma	1, 274	12, 283	16, 258	Yadkin, Wilkes, Surry, and Forsyth Counties.
	Tar River	Ma	1, 194	6, 672	14, 588	Granville, Vance, Franklin, and Nash Counties; part of Person County.
	Broad River	Ma	846	5, 477	9, 879	Rutherford, Polk, and Cleveland Counties; part of McDowell County.
	Catawba	Ma	1, 331	9, 233	11, 184	Catawba, Burke, McDowell, Caldwell, and Alexander Counties.
	Dan River	Ma	1, 166	6, 701	13, 846	Caswell, Rockingham, and Stokes Counties; part of Person County.
	Middle Yadkin	Ma	1, 468	10, 166	13, 984	Cabarrus, Davidson, Davie, Rowan, and Iredell Counties.
	Neuse River	Ma	1, 732	10, 744	20, 538	Wake, Durham, Orange, Johnston, and Wilson Counties.
	Haw River	Ma	1, 715	11, 583	14, 746	Alamance, Guilford, and Chatham Counties.
	Lower Catawba	Ma	806	5, 318	7, 978	Gaston, Lincoln, and Mecklenburg Counties.
	Upper Cape Fear	Ma	952	5, 273	8, 212	Lee, Moore, and Harnett Counties.
	New River	Ma	423	5, 030	5, 843	Alleghany and Ashe Counties.
	Total	13	14, 982			
North Dakota	Arnegard-Alexander	Ma	827	1, 020	1, 020	Part of McKenzie County.
	Kidder County	Ma	576	403	1, 039	Part of Kidder County.
	Slope-Hettinger	Ma	1, 014	1, 011	4, 082	Part of Slope and Hettinger Counties.
	Little Muddy	Ma	472	839	1, 798	Part of Williams County.
	Cedar	Ma	307	144	144	Part of Grant and Sioux Counties.
	Walsh County	Ma	461	1, 356	1, 827	Part of Walsh County.
	Wells County	Mab	829	1, 600	3, 000	Part of Wells County.
	Fort Berthold	Ma	438	782	1, 697	Part of Mountrail County.
	North Central	Mab	937	2, 127	3, 402	Part of Benson and Towner Counties.
	Mouse River	Mab	558	1, 021	1, 049	Part of Bottineau and McHenry Counties.
	Turtle Mountain	Ma	545	1, 232	1, 264	Part of Bottineau County.
	Nelson County	Mab	645	1, 125	1, 352	Part of Nelson County.
	Grand Fork	Mab	553	1, 302	1, 302	Part of Grand Forks County.
	Sargent County	M	184			Part of Sargent County.
	South Burleigh County	Ma	563	598	2, 200	Part of Burleigh County.
	Total	15	8, 909			
Oklahoma	Konawa	Ma	678	4, 105	4, 342	Part of Pottawatomie, Seminole, and Pontotoc Counties.
	Arkansas-Verdigris	Ma	611	4, 067	4, 294	Tulsa County; part of Wagoner and Roger Counties.
	Kiamichi	Ma	510	3, 522	3, 642	Choctaw County.
	Garvin-Murray	Ma	795	3, 989	4, 094	Garvin and Murray Counties.
	North Fork of Red River **	Mab	810	3, 125	3, 345	Beckham County; part of Washita County.
	Upper Washita **	Mab	1, 729	4, 495	5, 421	Roger Mills County; part of Custer and Washita Counties.
	McIntosh County	Ma	259	1, 248	1, 513	Part of McIntosh County.
	East Central Oklahoma **	Ma	1, 399	5, 391	5, 409	Part of Haskell, LeFlore, Latimer, and Pittsburg Counties.
	Gaines Creek	Ma	995	3, 527	3, 722	Part of Pittsburg and Latimer Counties.
	Cottonwood Creek	Ma	473	1, 981	2, 316	Logan County.
	Stephens County	Ma	574	2, 471	2, 592	Stephens County.
	Creek County	Ma	616	2, 769	3, 156	Creek County.
	Arbuckle	Ma	785	3, 391	3, 489	Carter County; part of Johnston County.
	Jackson County	Mab	498	1, 932	2, 048	Jackson County.
	Farm Security	Mab	339	1, 191	1, 248	Harmon County.
	Canadian-Walnut	Ma	360	1, 981	2, 266	McClain County.
	Central North Canadian	Mab	405	1, 471	1, 672	Part of Blaine and Canadian Counties.
	Muskogee-Okmulgee	Ma	602	3, 658	4, 070	Muskogee County; part of Okmulgee County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Oklahoma	Blue and Boggy	Ma	Thousands 794	3, 921	4, 076	Coal County; part of Pontotoc and Johnston Counties.
	Checotah	Ma	194	1, 009	1, 141	Part of McIntosh County.
	Harper County	Mab	661	769	945	Harper County.
	Verdi-Grand	Ma	122	721	913	Part of Wagoner County.
	Atoka County	Ma	638	1, 921	2, 069	Atoka County.
	Northern Hughes County**	Ma	538	2, 554	2, 740	Part of Hughes County.
	Little River	Ma	523	3, 521	3, 984	Part of McCurtain County.
	Grady County	Ma	653	2, 892	3, 148	Part of Grady County.
	Okfuskee	Ma	335	2, 491	2, 657	Okfuskee County.
	Seminole County No. 1	Ma	250	1, 601	1, 696	Part of Seminole and Pottawatomie Counties.
	Red River Valley	Ma	244	1, 296	1, 414	Love County.
	Arkansas River-Kay County	Ma	175	689	799	Part of Kay County.
	Big Pastures and West Tillman.	Mab	553	2, 004	2, 119	Part of Tillman County.
	Mayes County**	Ma	432	2, 349	2, 534	Mayes County.
	East Garfield County	Mab	150	664	783	Part of Garfield County.
	Cleveland County	Ma	355	1, 994	2, 061	Cleveland County.
	Shawnee	Ma	207	1, 115	1, 402	Part of Pottawatomie County.
	East Canadian County	Mab	301	1, 099	1, 218	Part of Canadian County.
	Valliant	Ma	116	354	443	Part of McCurtain County.
	Okmulgee County	Ma	400	2, 098	2, 391	Part of Okmulgee County.
	Bryan County	Ma	594	3, 396	3, 512	Bryan County.
	Sequoyah County	Ma	444	2, 302	2, 504	Sequoyah County.
	Cherokee County	Ma	493	2, 391	2, 507	Cherokee County.
	Lincoln County	Ma	614	3, 514	3, 862	Lincoln County.
	Mountain View	Mab	230	953	1, 003	Part of Washita and Kiowa Counties.
	Pushmataha County	Ma	915	1, 795	1, 919	Pushmataha County.
	Texas County	Ma	1, 322		1, 408	Texas County.
	Craig County	Ma	484	1, 849	2, 156	Craig County.
	Marshall County	Ma	268	1, 112	1, 252	Marshall County.
	Ellis County	M	774	1, 310	1, 443	Ellis County.
	East Beaver County	M	493			Part of Beaver County.
	Greer County		412	1, 501	1, 674	Greer County.
	Payne County		434	2, 380	2, 543	Payne County.
	North Caddo County		137	691	752	Part of Caddo County.
	Delaware County		508	2, 310	2, 683	Delaware County.
	Dewey County		633	1, 721	1, 931	Dewey County.
	Rogers County		454	1, 876	2, 049	Rogers County
	Oklahoma County		367	2, 380	2, 814	Part of Oklahoma County.
Total	56		29, 655			
Oregon	South Tillamook	Ma	20	82	98	Part of Tillamook County.
	Necanicum	Ma	5	13	14	Part of Clatsop County.
	Warrenton Dune	M	5	9	19	Do
	Keating	M	250	124	124	Part of Baker County.
	Langel Valley	Ma	33	95	95	Part of Klamath County.
	Heppner		702	400	660	Part of Morrow and Umatilla Counties.
Total	6		1, 015			
Pennsylvania	Black Lick	Ma	220	1, 095	1, 200	Part of Indiana and Cambria Counties.
	Lancaster	Ma	184	2, 139	2, 930	Part of Lancaster County.
	Clarion	Ma	385	2, 089	2, 199	Clarion County.
	York	Ma	307	4, 186	4, 186	Part of York County.
Total	4		1, 096			
South Carolina	Upper Savannah	Ma	1, 246	6, 310	13, 252	Anderson, Oconee, and Pickens Counties.
	Edisto	Ma	2, 299	8, 626	13, 559	Aiken, Barnwell, Allendale, Bamberg, and Orangeburg Counties.
	Broad River	Ma	1, 113	5, 270	11, 346	Spartanburg, Cherokee, and Union Counties.
	Catawba	Ma	1, 583	4, 920	10, 696	York, Chester, Lancaster, and Fairfield Counties.
	Lower Saluda	Ma	979	4, 198	7, 476	Newberry, Saluda, and Greenwood Counties.
	Congaree	Ma	1, 186	5, 466	7, 091	Richland, Lexington, and Calhoun Counties.
	Savannah Valley	Ma	566	1, 475	3, 441	Edgefield and McCormick Counties.
	Greenville County	Ma	505	3, 233	5, 607	Greenville County.
	Laurens County	Ma	456	1, 522	3, 285	Laurens County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
South Carolina	Abbeville County	Ma	326	1, 106	2, 474	Abbeville County.
	Lynches River	Ma	1, 206	5, 278	7, 943	Lee, Kershaw, and Sumter Counties.
	Pee Dee	Ma	1, 165	4, 684	9, 342	Darlington, Marlboro, and Chesterfield Counties.
	Total	12	12, 630			
South Dakota	Brown-Marshall	Mab	205	310	450	Part of Brown and Marshall Counties.
	Tri-County	Ma	1, 033	450	500	Part of Meade, Ziebach, and Porkins.
	Tulare-Redfield	Mb	183	334	340	Part of Spink County.
	Brule-Buffalo**	Ma	395	488	496	Part of Brule and Buffalo Counties.
	Clearfield-Keyepaha	Ma	211	289	335	Part of Tripp County.
	American Creek	Ma	439	532	539	Part of Lyman County.
	Silver Creek	Mab	237	648	972	Part of Sanborn County.
	Emanuel-Choteau Creek	Ma	203	875	925	Part of Charles Mix and Bon Homme Counties.
	Clay County	Ma	138	571	593	Part of Clay County.
	Sioux-Brule	Ma	186	1, 000	1, 022	Part of Union County.
	Pennington	Ma	83	92	100	Part of Pennington County.
	Lawrence-Butte	Ma	255	696	725	Part of Lawrence and Butte Counties.
	Custer County	Ma	357	215	240	Part of Custer County.
	Carpenter County	Mab	207	398	450	Part of Beadle, Clark, and Spink Counties.
	Elk Creek	Ma	195	160	175	Part of Meade County.
	Lincoln	Ma	56	289	304	Part of Lincoln County.
	Rosebud	Ma	26	38	42	Part of Todd County.
	Roberts	Ma	361	1, 684	1, 800	Part of Roberts County.
	Scotland	Ma	192	580	675	Part of Bon Homme County.
	Fall River	Ma	191	225	225	Part of Fall River County.
	Jackson County	M	395	287	400	Jackson County.
	Minnehaha		141	646	646	Part of Minnehaha County.
	Gregory County		87	153	307	Part of Gregory County.
	Total	23	5, 776	10, 314	11, 615	
Tennessee	South Lauderdale	Ma	90	932	968	Part of Lauderdale County.
	Sumner Highland Rim	Ma	130	2, 049	2, 583	Part of Sumner County.
	Reelfoot Creek	Ma	97	638	803	Part of Obion County.
	Gibson County	Ma	405	5, 436	6, 227	Gibson County.
	Weakley County	Ma	371	4, 525	4, 686	Weakley County.
	Putnam County	Ma	257	2, 550	3, 349	Putnam County.
	Rutherford County	Ma	394	3, 325	4, 450	Rutherford County.
	Robertson County	Ma	281	2, 564	3, 668	Robertson County.
	Madison County	Ma	353	2, 652	4, 151	Madison County.
	De Kalb County	Ma	199	1, 996	2, 765	De Kalb County.
	Hardeman	Ma	440	2, 070	2, 961	Hardeman County.
	Crockett County		171	2, 250	2, 748	Crockett County.
	Dyer County		320	2, 700	3, 217	Dyer County.
	Warren County		227	2, 700	2, 777	Warren County.
	Tipton County		283	2, 438	4, 166	Tipton County.
	White County		232	2, 100	2, 196	White County.
	Total	16	4, 250	40, 925	51, 715	
Texas	Hays-Caldwell-Travis	Ma	848	3, 879	4, 114	Caldwell County; part of Hays and Travis Counties.
	Duck Creek	Ma	1, 116	1, 850	1, 979	Part of Dickens, Kent, and Stonewall Counties.
	Nacogdoches County	Ma	817	4, 670	4, 974	Nacogdoches County; part of Rusk County.
	Kaufman-Van Zandt	Ma	736	5, 562	5, 689	Kaufman County; part of Van Zandt County.
	Harrison County	Ma	558	4, 582	5, 306	Harrison County.
	Hamilton-Coryell	Ma	1, 229	4, 300	4, 600	Hamilton and Coryell Counties.
	Central Colorado	Ma	1, 168	2, 859	3, 011	Coleman County; part of Calahan, Taylor, and Runnels Counties.
	Martin-Howard	Ma	1, 232	1, 474	1, 595	Martin County; part of Howard, Glasscock, and Midland Counties.
	Karnes County	Ma	1, 296	3, 501	3, 795	Karnes and Bee Counties; part of Goliad County.
	Bowie County	Ma	559	3, 310	3, 892	Bowie County.
	Shelby-Panola	Ma	1, 168	7, 180	8, 703	Shelby and Panola Counties; part of Rusk County.
	Sabine River-Cypress	Ma	662	4, 820	5, 227	Upshur and Gregg Counties; part of Smith County.
	Anderson-Houston	Ma	580	3, 183	3, 656	Part of Anderson and Houston Counties.
	Dallam (WED)	Ma	980		473	Dallam County.
	Deaf Smith (WED)	Ma	991		854	Deaf Smith County.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Texas			Thousands			
	Oldham (WED).....	Ma	988	.....	177	Oldham County.
	Hansford (WED).....	Ma	564	.....	335	Hansford County.
	Hartley (WED).....	Ma	964	.....	207	Hartley County.
	Moore (WED).....	Ma	589	.....	178	Moore County.
	Ochiltree (WED).....	Ma	570	.....	528	Ochiltree County.
	Lipscomb Co. (WED).....	Ma	572	.....	479	Lipscomb County.
	Wilson County.....	Ma	524	2, 030	2, 092	Wilson County.
	Sulphur-Cypress.....	Ma	738	6, 015	6, 021	Morris, Titus, Franklin, and Camp Counties.
	Davy Crockett-Trinity County.	Ma	1, 097	4, 230	5, 035	Trinity County; part of Walker and Houston Counties.
	Hopkins-Rains-Wood.....	Ma	1, 111	8, 118	8, 742	Hopkins, Rains, and Wood Counties.
	San Jacinto * *.....	Ma	1, 575	4, 277	5, 538	Montgomery County; part of Waller, Grimes, Walker, San Jacinto and Liberty Counties.
	Ellis-Prairie.....	Ma	653	3, 706	4, 073	Part of Ellis, Hill, and Johnson Counties.
	Upper West Fork.....	Ma	935	3, 150	3, 310	Part of Archer, Young, Clay, Jack, Montague, and Wise Counties.
	Taylor.....	Ma	1, 108	5, 430	5, 448	Part of Milam, Williamson, and Travis Counties.
	Palo Pinto.....	Ma	909	1, 920	2, 366	Palo Pinto County; part of Jack, Erath, and Eastland Counties.
	Floyd County.....	Mab	647	.....	1, 317	Floyd County.
	Middle Guadalupe Basin...	Ma	1, 215	5, 224	6, 888	Gonzales and DeWitt Counties.
	Trinity-Neches.....	Ma	973	6, 395	6, 555	Henderson County; part of Van Zandt and Anderson Counties
	Little River-San Gabriel....	Ma	770	3, 200	3, 569	Part of Bell, Williamson, and Milam Counties.
	Central Texas.....	Ma	784	6, 578	6, 973	Part of Bell, Milam, and Falls Counties.
	McLennan County.....	Ma	786	4, 310	4, 643	McLennan County; part of Hill County.
	Navarro-Hill.....	Ma	1, 090	6, 138	6, 444	Navarro County; part of Hill, Ellis, Freestone, and Limestone Counties.
	Red River County.....	Ma	665	3, 558	3, 726	Red River County.
	Limestone-Falls.....	Ma	844	5, 109	5, 322	Part of Limestone, Hill, and Falls Counties.
	Dalworth.....	Ma	1, 376	6, 810	7, 708	Dallas & Tarrant Counties; part of Kaufman, Johnson and Ellis Counties.
	Concho.....	Ma	1, 088	1, 390	1, 422	Part of Concho, McCulloch, Tom Green, and Menard Counties.
	Middle Clear Fork.....	Ma	848	2, 411	2, 513	Part of Nolan, Jones, Shackelford, Callahan, and Taylor Counties.
	Toyah-Limpia.....	Ma	1, 126	114	133	Part of Reeves, Jeff Davis, and Pecos Counties.
	Highland.....	Ma	1, 919	285	329	Part of Jeff Davis, Presidio, and Brewster Counties.
	Atascosa County.....	Ma	1, 008	1, 907	2, 211	Atascosa County; part of Medina, Frio and McMullen Counties.
	North Texas.....	Ma	605	4, 190	4, 176	Lamar County.
	Freestone Leon.....	Ma	876	3, 810	3, 892	Part of Freestone and Leon Counties.
	Fannin County.....	Ma	568	4, 487	4, 538	Part of Fannin and Grayson Counties.
	El Paso-Hudspeth.....	Ma	1, 376	1, 063	1, 111	El Paso County; part of Hudspeth County.
	Comal-Hays-Guadalupe....	Ma	960	3, 831	3, 834	Comal and Guadalupe Counties; part of Hays County.
	Mitchell County.....	Ma	832	1, 320	1, 335	Mitchell County; part of Nolan, Scurry, and Sterling Counties.
	Cochran-Yoakum-Terry....	M	1, 676	.....	.....	Cochran, Yoakum, and Terry Counties.
	North Concho River.....	M	1, 136	832	976	Part of Glasscock, Sterling, Coke, and Tom Green Counties.
	California Creek.....	Ma	832	2, 147	2, 442	Part of Haskell, Shackelford, Fisher, Jones, and Throckmorton Counties.
	Crosby County.....	.....	556	.....	1, 288	Crosby County.
	Lubbock County.....	.....	556	.....	2, 119	Lubbock County.
	Hall County.....	.....	1, 122	.....	.....	Hall and Childress Counties; part of Cottle County.
	Swisher County.....	.....	575	.....	1, 035	Swisher County.
	Blackwater Valley.....	.....	659	.....	820	Bailey County.
	Upper Colorado.....	M	568	1, 640	1, 646	Scurry and Borden Counties.
	San Diego-Agua Dulce.....	.....	947	1, 897	2, 052	Jim Wells County; part of Duval and Nueces Counties.
	Neches-Sabine.....	.....	614	5, 677	5, 879	Part of Smith and Van Zandt Counties.
	Bedias Creek.....	.....	832	3, 549	3, 777	Madison County; part of Grimes, Walker, and Leon Counties.
	Piney Woods.....	.....	398	1, 810	2, 162	San Augustine County.
	Bosque.....	M	1, 203	3, 810	3, 827	Bosque and Somervell Counties; part of Erath County.
	Brown-Mills.....	.....	445	3, 351	3, 483	Mills County; part of Brown County.
	Upper Elm-Red.....	M	1, 533	5, 159	5, 229	Cooke County; part of Grayson and Montague Counties.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Texas	Upper Leon	M	Thousands 1, 036	4, 350	4, 391	Eastland County; part of Comanche and Erath Counties.
	Miller-Brazos		871	968	975	Part of Baylor, Throckmorton, Stephens, and Shackelford Counties.
	Denton-Wise		784	4, 091	4, 137	Denton County; part of Wise County.
	Hood-Parker		819	3, 254	3, 545	Hood and Parker Counties.
	El Dorado Divide		1, 127	649	652	Schleicher County; part of Tom Green County.
	Upper Sabine		572	4, 381	4, 462	Hunt County.
Total	73		66, 054			
Utah	Minersville	Ma	43	52	61	Part of Beaver and Iron Counties.
	Price River Watershed	Ma	1, 217	380	535	Carbon County; part of Duchesne, Utah, Wasatch, and Uintah Counties.
	Enterprise	Ma	183	73	93	Part of Iron and Washington Counties.
	La Verkin and Ash Creek	Ma	201	160	203	Part of Iron and Washington Counties.
	Grantsville	Ma	45	180	180	Part of Tooele County.
	Huntington River	Ma	439	320	380	Part of Emery County.
	Morgan	Ma	298	250	250	Part of Morgan County.
	Lower Virgin and Santa Clara	Ma	602	270	330	Part of Washington County.
	South Slope Upper Virgin River	Ma	200	248	275	Part of Washington County.
	Northern Utah	Ma	467	700	700	Part of Box Elder County.
	East Salt Lake County	Ma	141	200	200	Part of Salt Lake County.
	West Salt Lake County	Ma	124	550	550	Part of Salt Lake County.
	Green River	Ma	1, 520	80	99	Part of Emery and Grand Counties.
	San Juan County	Ma	3, 500	415	507	Part of San Juan County.
	Grand County Colorado River Drainage	Ma	1, 500	127	146	Part of Grand County.
	Paria River and tributaries	Ma	150	105	128	Part of Garfield County.
	South Emery	Ma	1, 789	480	590	Part of Sanpete, Sevier, and Emery Counties.
	Uintah Basin	Ma	5, 436	2, 288	2, 859	Part of Uintah, Grand Duchesne, and Wasatch Counties.
	Vernon		20	100	100	Part of Tooele County.
	Sanpete		1, 030			Part of Sanpete County.
Total	20		18, 905			
Vermont	Poultney-Mettawee	Ma	257	856	910	Part of Rutland and Bennington Counties.
	White River	Ma	434	1, 500	1, 690	Part of Addison, Orange, Windsor, and Rutland Counties.
	Winooski	Ma	750	3, 300	3, 490	Part of Chittenden, Washington, Lamoille, and Orange Counties.
	Otter Creek		850	2, 700	3, 000	Parts of Chittenden, Addison, Rutland, and Bennington Counties.
Total	4		2, 291			
Virginia	Tidewater	Ma	1, 381	7, 475	8, 338	Essex, King and Queen, Caroline, King William, Hanover, Middlesex, and Mathews Counties.
	Thomas Jefferson	Ma	1, 276	6, 859	7, 808	Albemarle, Goochland, and Nelson Counties; part of Louisa County.
	Southside	Ma	1, 898	9, 668	17, 107	Charlotte, Halifax, Lunenburg, Mecklenburg, and Brunswick Counties.
	Natural Bridge	Ma	628	2, 788	3, 145	Rockbridge County; part of Botetourt County.
	Piedmont	Ma	1, 172	5, 903	7, 434	Amelia, Nottoway, Prince Edward, Powhatan, and Dinwiddie Counties.
	Culpeper County	Ma	782	3, 469	3, 785	Culpeper, Orange, and Madison Counties.
	Blue Ridge	Ma	1, 900	11, 569	17, 133	Bedford, Franklin, Henry, and Pittsylvania Counties.
	Northern Neck	Ma	506	3, 446	3, 886	Lancaster, Richmond, Northumberland, and Westmoreland Counties.
	Shenandoah Valley	Ma	1, 204	6, 760	7, 603	Augusta and Rockingham Counties.
	Robert E. Lee	Ma	899	4, 447	5, 839	Buckingham and Campbell Counties; part of Appomattox County.
	New River	Ma	565	6, 242	6, 942	Carroll and Grayson Counties.

TABLE 2.—Name, approximate acreage, number of operating units, number of farms, and general location of soil conservation districts established to Dec. 15, 1941—Continued

State	Name of District	See Note for symbols	Approximate acreage	Approximate number		General location
				Operating units	Farms	
Virginia	James River	Ma	Thousands 667	3, 379	3, 656	Chesterfield, Henrico, and Prince George Counties. Frederick County.
	Lord Fairfax	Ma	278	1, 488	1, 674	
Total	13		13, 156			
Washington	North Palouse	Ma	156	393	535	Part of Whitman County.
	Latah, Rock Creek	Ma	185	500	700	Part of Spokane and Whitman Counties.
	Loomis	Ma	125	140	160	Part of Okanogan County.
	Asotin County	Ma	197	170	170	Part of Asotin County.
	Puget Island	Ma	5	178	196	Part of Wahkiakum County.
	Montesano-Elma-Oakville	Ma	684	2, 600	1, 700	Part of Mason, Grays Harbor, and Jefferson Counties.
	Eastern Klickitat	Ma	442	125	131	Part of Klickitat and Yakima Counties.
	Underwood	Ma	319	600	700	Parts of Skamania and Klickitat Counties.
	Douglas	M	132	136	145	Part of Douglas County.
	Walla Walla		172	260	260	Part of Walla Walla County.
	Moses Coulee		186	127	131	Parts of Grant, Douglas, and Chelan Counties.
	Pine Creek	M	183	560	751	Part of Spokane and Whitman Counties.
	Wenas Valley		125	110	110	Yakima and Kittitas Counties.
	Snohomish		408	3, 619	3, 731	Part of Snohomish County.
Total	14		3, 319			
West Virginia	West Fork	Ma	518	4, 029	4, 618	Harrison and Lewis Counties.
	Eastern Panhandle	Ma	357	1, 823	2, 068	Morgan and Berkley Counties.
	Greenbrier Valley	Ma	931	3, 768	4, 640	Greenbrier and Monroe Counties.
	Tygart Valley	Ma	294	2, 456	3, 032	Barbour County; part of Upshur County.
	Western	Ma	304	2, 096	2, 326	Mason County.
	Elk		415	2, 035	2, 277	Nicholas County.
Total	6		2, 819			
Wisconsin	Crawford	Ma	371	1, 925	1, 960	Crawford County.
	Buffalo County	Ma	449	2, 132	2, 171	Buffalo County.
	Pepin County	Ma	150	1, 018	1, 100	Pepin County.
	La Crosse County	Ma	302	1, 765	1, 759	La Crosse County.
	Vernon County	Ma	522	3, 919	3, 979	Vernon County.
	Iowa County	Ma	485	2, 640	2, 765	Iowa County.
	St. Croix County	Ma	467	3, 543	3, 737	St. Croix County.
	Trempealeau County	Ma	475	3, 050	3, 278	Trempealeau County.
	Eau Claire County	Ma	411	2, 421	2, 504	Eau Claire County.
	Pierce County	Ma	370	3, 104	3, 280	Pierce County.
	Grant County	Ma	738	3, 926	4, 286	Grant County.
	Dunn County	Ma	550	3, 600	3, 800	Dunn County.
	Jackson County	Ma	639	2, 073	2, 205	Jackson County.
	Dane County	Ma	765	5, 835	6, 250	Dane County.
	Waushara County	Ma	402	1, 852	2, 650	Waushara County.
	Barron County	Ma	561	4, 700	5, 112	Barron County.
	Monroe County	Ma	583	3, 530	3, 591	Monroe County.
	Richland County	Ma	377	2, 557	2, 592	Richland County.
	Sauk County	Ma	537	3, 552	3, 642	Sauk County.
	Juneau County		511	2, 446	2, 545	Juneau County.
	LaFayette County	M	401	2, 404	2, 602	LaFayette County.
	Polk County		594	4, 500	4, 868	Polk County.
	Chippewa County		662	4, 250	4, 539	Chippewa County.
	Clark County		779	5, 573	5, 845	Clark County.
	Marathon County		1, 009	6, 937	7, 198	Marathon County.
	Wood County*		520	3, 568	3, 728	Wood County.
	Dodge County*		571	4, 602	4, 864	Dodge County.
Total	27		14, 201			
United States	653 (549 M with 337,525,000 acres.)		382, 629			



Ice plant protecting roadcut from erosion, Skyline Boulevard.

CONSERVATION COMES TO THE GOLDEN GATE

By H. H. BENNETT Chief, Soil Conservation Service

IN THE hill country of San Mateo County, not far from world-famed Golden Gate, cabbages and artichokes grow to luscious and profitable proportions. Gullies form there too—lustly fellows—if left to their own devices, under the wasteful land-use practices that have prevailed.

Dairying is an important agricultural activity also, and they raise hogs with garbage trucked in from the metropolitan area of San Francisco, immediately to the north. Selling topsoil to city people is another important business with some landowners. We saw them bull-dozing rich, black loam from good farm land and hauling it to town where it was spread over “blow sand” of front and back yards of scores of new houses along brand new streets building up across the wind-whipped dune sands of the locality. A 6-inch layer of it, we found, effectively holds the fickle sands and produces beautiful grass, flowers, and shrubs.

But the subsoil, exposed by the stripping process, produces little or nothing and erodes with extraordinary violence. Rains gut it rapidly and deeply; and troublesome silt is added to that pouring from other exposures.

Harvesters of topsoil take their pay in money; while the afflicted community takes on the resultant burden

of handling the products of erosion spread over highways, parks, and baseball fields and dumped into creeks and culverts.

The San Mateo Soil Conservation District has posted signs over the countryside promising prosecution of those who take topsoil at will from public property. Neither salesmen of topsoil, however, nor those who take sacks and trailer loads of topsoil when no one is around to object are responsible for the main erosion problem of the locality.

The principal starting place of the difficulties arising out of uncontrolled soil erosion is in the rows of cabbages and artichokes that run downhill, and in the fields of cabbages and artichokes left bare over winter. Here begin most of the gullies that have been permitted, even thoughtlessly encouraged, to run along as they choose.

I was not prepared for any such dimensions as we found in some of those California gullies. To me—and I had told a lot of people about it—the great gully over in southwestern Georgia, Providence Cave, was the most formidable man-caused gash in the body of the Western Hemisphere. Well, Providence Cave was just that, so far as I knew, until October 24, 1941, when we ran into the gullies of San Mateo. It must



Gullying of subsoil, after topsoil has been stripped off for sale, San Mateo County.

be admitted, however, that we do not yet have the final answer as to comparative sizes. It is not easy to measure the depth of such big gullies; they gape and sprawl about so you don't know where to place your benchmarks. After all, precise measurements are not so important, since both the Georgia and California chasms belong to the order of Grade A gullies.

According to Coast and Geodetic and United States Geological Survey maps, and rechecks with instruments, Sir Francis Drake Gully seems to be about 275 feet deep. This one heads in the cabbage and artichoke patches about 10 miles south of the center of the Golden Gate Channel and empties into the Pacific Ocean. Local information puts its age at less than 50 years.

The proprietor of Gopher Hole, another whiz of a gully not far from the Sir Francis Drake, estimates its depth at 245 feet. The owner said: "As a boy I played all over where that gully is. It was just a smooth hillside then. The washing started in a gopher hole about 35 years ago."

"Any of your cows ever fall in it?" I inquired.

"Oh yes; several times. But they are pretty careful generally. Those that went down were accidentally pushed in by other cows. Thus far, they've landed on benches where we've been able to rescue 'em. But 2 weeks ago one of my cows was killed by falling into the gully on the other side of the ridge." I forgot to ask the depth of the gully on the other side, but it was on the same dairy ranch.

The truck farmers were not so easy to talk to. They were busy harvesting cabbages and irrigating artichokes; some disclaimed acquaintance with the English language. What is more important is that

some 35 of the local farmers and dairymen are cooperating with the soil conservation district. W. G. Scott of the Service has drawn up conservation plans for these ranches and is now assisting the district in getting control measures applied to the land—mostly contour cultivation, winter cover crops, mulching with straw, crop rotations, vegetative plantings, drainage (artichokes do not like soggy ground), and improvement of irrigation practices.

Erosion control work in the San Mateo District does not stop with the farmers but extends to cooperation with county authorities in the protection of highways. I was told that \$100,000 will be made available by county and highway officials for the protection of Junipera Serra Boulevard. About \$10,000 of this is being used by the Soil Conservation Service for installing eight silting basins above the road fill. With "risers" for the culverts, the silt will be retained from eight bad gullies tributary to Colma Creek. Veritable deluges of sand have been pouring out from the highly erodible strata exposed in the gullies and along highways.

I was told that during the past 8 years \$400,000 has been spent in handling flood waters and erosion debris along Colma Creek. This creek flows through South San Francisco. A channelway about 12 feet deep was recently opened through the accumulated sand, which has now piled up to a depth of 25 to 30 feet—within the memory of people living near the stream. This channelway has been lined with rock along its bottom and lower sides, but still sand pours in with every rain.

To hold back in-flowing sand the walls of a local pump house have been raised twice within 35 years. Near this point barges once brought feed from the



Hauling topsoil into the backyard of a home on 35th Avenue near Noriega in San Francisco.

bay up to the Charles Lux ranch. Now the nearest navigable water for any kind of boat is nearly a mile away—the waters of San Francisco Bay.

We also looked over the work being done for control of erosion and prevention of silting on the watersheds of the five reservoirs of the East Bay Municipal Utility District. This district supplies water to an urban population of some 600,000 people and to the huge, widespread industrial plant of the East Bay section. The East Bay District uses not only the run-off from the 55,000 acres within the watersheds of its five reservoirs but pipes in by gravity hundreds of millions of gallons from the foothills of the Sierras, 93 miles away.

One of the reservoirs, at the time of a recent survey, had the highest silt-producing rate shown by any sedimentation survey in the country. The investigation revealed a rate of sedimentation equal to the removal of around 9 tons of soil per acre per annum.

Here, the principal source of erosion is the slide areas. Some of the more recent of these have reached down to reservoir water. Much of the trouble has been caused by the washing that takes place within and around the slide areas. Erosion along highways and in overgrazed pastures also contributes much of the silt.

The plans for control operations were prepared by the Soil Conservation Service.

A number of silting basins already have been installed (two that we saw have collected enough silt to fill up) and much control work has been done on road fills. About 1,200 acres of steep erodible land are being planted to trees, 150 check dams are being put in (some of which will probably cost \$500 to \$1,000), grazing and fires are being controlled, and cover crops used on the cultivated areas.

Leaving this difficult but essential erosion-control project to see some of the work in Walnut Creek and San Ramon Valleys, we passed an interesting conservation operation in progress at Lafayette. Here two stone-masonry dams were being installed in the expanding channel of Tramos Creek. The accelerated erosion at this point was about to take out an important county bridge 1,000 feet upstream and was threatening the property, valued at \$125,000, of 25 people living along the banks of the stream. The Service designed the structures and furnished stone mined by a CCC camp; the property owners paid for the cement and other materials, and the county was supplying the labor and installing the structures.

Among several farms visited farther on, where soil and water conservation plans had been installed, I was particularly impressed with results obtained on a 1,200-acre ranch in San Ramon Valley. On this ranch a stockwater reservoir, installed by placing an earth dam across a small waterway which for many years had been flooding out an adjoining 175-acre field of rich bottomland, has provided adequate protection for the flooded field. A diversion ditch now carries the excess water from the reservoir to a safe disposal outlet. As the result of these water-control and water-supply installations, the flat which hitherto has grown little or nothing, produced this year 30,000 pounds of vetch seed that sold for 5½ cents a pound; 140 tons of hay that brought \$11 a ton; and a rental return of \$1 an acre for temporary grazing. In 1941 the total income from this previously useless field amounted to \$3,365. Nor did this cover all the increased income resulting from the soil and water conservation work. For example, the development of spring water on another part of the farm made it

possible to utilize profitably for grazing a previously unused area of 500 acres.

The day after the visit to these farms I undertook to tell members of the natural resources section of the California Chamber of Commerce how simple the job of soil and water conservation is in some places and how complex and difficult it is in others; how the work has increased income to farms and ranches and benefited the general welfare; and something of the cost of not controlling erosion. Afterwards, a member of the board of supervisors of one of the larger southern California counties told me his county would contribute \$100,000 to assist in the control of erosion as soon as a soil conservation district is established there, which he thought would be very soon.

Another gentleman told me that after the severe erosion during the early part of 1941, farmers and ranchers of the same county had requested a reduction of assessments on their lands because of the washing of uplands and the covering of valley farms with the products of erosion. One county was prepared, I was informed, to contribute probably \$300,000 to erosion control and related activities.

Up in the Placerville locality, north of Sacramento, one occupant of the land did not seem as much concerned as we were about the erosion taking place on the pear and peach ranch where he lived—we could not convince him that gold from pears is better than gold taken from gullies. He expressed his opinion this way: "It takes a lot of work to keep up a big orchard and when you go financially flat for one cause or another this soil washing is a good thing, because you don't have to dig so much to get down to gold. There's gold all over this orchard, but I haven't yet found where it is concentrated. I planted pears in this field 20 years ago and the peaches over there 3 years ago. You can find fruit trees even in those pines over beyond the house. The place has been in fruit for probably 70 years."

When we met this pear and peach rancher coming in from his gold digging in the severely gullied, bush-invaded, 20-year-old pear orchard, he had a small sack of gold dust or "pay dirt" on his shoulder. He said this would pay him at the rate of \$1 to \$3 a day when washed out at the spring.

He did not seem especially enthusiastic over the suggestion that it might pay to prune and take more care of the better pear trees on the less eroded parts of the farm. In search of gold, he had made so many excavations that the going was not very good—I was dodging invading clumps of poison oak and the ever-deepening exploratory gold holes until finally they turned me

back. If a man wants to take his gold where he finds it perhaps there is little that can be done about it.

Not so with Roy Marks, president of the Central Eldorado Soil Conservation District, over on the other side of Placerville. Roy has gone in for soil conservation so completely that he not only never plows his pear orchard any more but he gets good grazing for sheep from the protective cover of grass that has been established between the trees. His irrigation water comes from a ditch maintained by himself and six neighboring farmers. "We used to clear the ditch of silt every year," he said. "We must have thrown out of it all the topsoil of three ranches. Now you couldn't grow a bale of hay on 20 acres of some of those places that used to be good ranches."

Roy Marks' story is interesting. This is the way he told it: When the Soil Conservation Service first came in here it was hard to get an application for work from a rancher, but now we don't have any trouble of that nature. Everbody wants to come in. Most people have quit the cultivating they used to do. We used to make a powder of our soil and kill every weed and sprig of grass in the orchards. Now the only cultivation we use is just enough to put in irrigation ditches.

"When I stopped plowing my orchard, the neighbors said I was neglecting my ranch. No complaint now though, even with sheep roving in the orchard. They don't hurt a thing, but take out a lot of weeds and pack down the grass so as to make a mat that helps hold irrigation water and keeps moisture in the ground. The yields are not harmed in the least by keeping on a cover crop. My irrigation furrows used to cut out a ditch sometimes 2 feet deep in a season. I don't have any more of that waste of good soil now.

"Soil conservation pays not only for this generation but for the next. But a farmer can't apply these conservation practices unless someone who knows comes and helps him. A farmer who does his own work on the ranch does not have time to go out and learn how to do these things, although he can handle them when he gets properly started and works with them for a while."

Someone pointed out that the sheep eat a lot of fallen pears, and thus help keep down the codling moth. At any rate, with the good crop and the good prices, ranchers around Placerville generally are taking to the new methods as fast as they can get them established.

The Central Eldorado District comprises 30,000 acres and about 300 farms—nearly all of them irrigated fruit ranches. Five years ago, I was told, probably

half the growers clean-tilled their orchards; now not more than 5 percent practice clean tillage. The planting of protective cover crops began in 1936.

Some of the ranchers have gone in for farm forestry. The income from such woodland operations on 16 ranches in the Placerville locality has ranged from \$50 to \$1,500 per ranch annually. This was income that did not come in before Soil Conservation Service technical help was supplied.

I talked with Dan Gardner about his farm forestry operations. We met him out in his woods—mostly cut-over western yellow pine, with some Douglas fir—with a truckload of firewood he had just cut. I asked him point-blank, right on the ground, if the Service woodland assistance had been satisfactory. "Yes it has," he came back instantly. "From this assistance I got \$768 net income the first year, not a penny of which I would have received but for the help of the Soil Conservation Service. I like the work of your Service, all of us do, and we like the technicians helping the district."

At this junction Mace Lumsden, district conservationist, said, "Dan, I think we are going to get you another order for fence posts, maybe a good one. It looks pretty sure."



Alfred E. Coe, Jr., a deputy sheriff, sees to it that topsoil isn't stolen in the San Mateo Soil Conservation District. He patrols at least once a day, and on Saturdays, Sundays, and holidays makes three patrols. Those caught helping themselves to the rich loam receive a warning if they are first offenders. A second offense is prosecuted.



Excellent cabbages from rich, loamy topsoil along Skyline Boulevard, San Mateo County, October 1941.

That obviously was good news for Gardner. I had to satisfy my curiosity about those posts: It turned out that during the past year 656 yellow pine fence posts, treated with zinc chloride, were sold from the Gardner ranch for 45 cents each—a very profitable transaction, everyone felt.

As to further operations, the farm forestry specialists who drew up the forest operations plan for the Gardner ranch figure that on a sustained-yield basis the 240 acres of second-growth woodland should yield a net annual income of at least \$700—for fuel wood, poles, lumber, mine timber, Christmas trees, and Christmas berries. If the sale of treated fence posts becomes a regular thing, the returns should be better still. Furthermore, cream is being sold from the 8 to 10 dairy cattle kept on the Gardner ranch; and there is an excellent farm garden.

A considerable number of “overnight reservoirs” have been constructed in the Placerville section for making better use of irrigation water. An inheritance of the placer mining culture of Hangtown’s gold-mining days (Hangtown is an old name for Placerville) was the *miners inch*. Water is still sold on that basis in this locality; that is, you pay so much for a stream of water that runs all day and night at the rate of 11 gallons a minute. The orchardists turn the water on and let it run day and night—and never have sufficient “head” to irrigate efficiently. The continuous trickle causes a lot of unnecessary wastage of water, as well as soil leaching. With the overnight reservoir, a simple earthen structure thrown up like a pen to hold the *miners inch* during the night, enough water is available next day to make a quick and efficient application.

We took the road leading into the high Sierras, spending the night at Strawberry Lodge, 18 miles from Lake Tahoe, at an elevation of nearly 6,000 feet. It was dark most of the way up. Twice deer threatening to cross the road ahead of us necessitated quick application of brakes.

Next day was Sunday and we spent most of it across the divide in Nevada. It was a perfect day. The high Sierras were tipped with new snow. Here and there autumn gold of aspen painted the high slopes so beautifully against a background of green conifers and snowy peaks that our photographer could not resist taking colored shots of the brilliant scenes. Lower down, along the valley floor, ribbons of equally golden cottonwood followed the meanders of Walker River and its tributaries. Sunlight on the trees covered them with magical beauty.

Atmosphere and sunshine were patterned perfectly for a late October day. A little walking here and

there had tuned up the appetite. We ordered a second breakfast at Minden, in Carson Valley. Then, duly reinforced, we were back to the objectives of the day: a look at problems of high water-table due to over-irrigation or lack of drainage outlets, or both, and the resultant deterioration of alfalfa fields; neglected and eroding irrigation ditches; great quantities of unused ranch fertilizer; irrigation ditches improperly safeguarded from the destroying effects of mountain torrents and the effectiveness of the measures used to solve these problems.

We saw the good effects of manure used on alkali spots, and eroding irrigation ditches stabilized with check dams and properly installed flumes. At Wellington, in Smith Valley, we saw two irrigation canals that had been protected from mountain torrents by structural overpasses made of cement.

On several ranches that we visited, irrigation practices had been improved by shortening the run and distributing water more nearly on the contour. We saw sloping, erodible land that had been brought into productive use under controlled irrigation, and pastures improved by seeding better grasses and legumes and by rotation with tilled crops. We saw also tree plantings, new gardens, and preparations for lowering the water table by drainage.

It was in Carson Valley, at the headquarters corral of a large ranch, that we saw areas occupied by huge piles of manure, the accumulation of decades. Someone referred to them as “the brown sierras.” An estimate of the accumulation at this one place was the amazing quantity of 750,000 tons. At other corrals on the same ranch enough was found to bring the amount to a million tons. In other words, this one ranch had on hand enough manure to fertilize 100,000 acres at the rate of 10 tons per acre! Some of the older accumulations undoubtedly have deteriorated, but even this has been found to have considerable fertilizing value. Ranch manure is now being used on an increasing scale, according to local report, for both pasture and wheat land.

The day’s journey took us by the ancient mining town of Virginia City. The old place, which a little while ago was a ghost town, and mining operations over a wide surrounding territory, have come into a very lively renaissance as the result of increased price for gold. At a distance the piles of freshly excavated material about the mouths of new openings and in nearby dump-heaps were suggestive of gopher operations on a grandiose scale.

To end this western trip, I’ll stop with the beginning incident: On the way out, I attended the annual State meeting of the supervisors of soil conversation

districts, at Grand Junction in Colorado. The discussions and district reports revealed the keenest kind of interest in ways and means for getting more soil conservation of a permanent nature, more conservation of water and better land use, through increased assistance to districts on the part of all agencies having anything to do with the land. The spirit of cooperation pervaded the meeting. There was no question about the success of the soil conservation district movement in Colorado or the determination of district supervisors to make them increasingly useful to the people.

The experience of the Horse-Rush Creek Soil Conservation District in leasing tax-delinquent lands from the county commissioners of Elbert County stands out in my recollection of the proceedings. This lease, as reported at the meeting, had just been signed by R. W. Lambert, chairman, Board of Elbert County Commissioners, and N. N. Bailey, chairman of Horse-Rush Creek Soil Conservation District.

Of some 50,000 acres of tax-delinquent land, the soil conservation district had leased 12,160 acres in 59 different tracts which had paid no taxes for 5 years or more. The terms for payment in all instances were based on the use capabilities of the land. For classes III and IV lands the district agreed to pay the county 8 cents an acre for 3,660 acres for pasture or range use; 10 cents an acre for 566 acres for crop use; and 4 cents an acre for 3,809 acres of abandoned land. For classes VI, VII, and VIII land the rates were fixed at 6 cents an acre for pasture or range use and 2 cents an acre for abandoned land.

Under the district program these lands are to be safeguarded against erosion and improved in every practical way in the interest of more profitable use.

Thus, the ways of soil conservation are leading us in the direction of a permanent basis of productive soil, for permanent agriculture all the way to the vicinity of the Golden Gate.



Poorly drained land being cleared.

LAND FOR MORE PEOPLE IN THE MISSISSIPPI DELTA

(Continued from back cover)

fields, are seen along or close to well-designed concrete highways and within a few miles of thriving communities.

To one interested in land drainage these conditions are of particular significance. Formerly this section of the State was subjected to overflow from the Mississippi and tributaries such as the St. Francis, White, and Arkansas Rivers and was largely classed as swamp land. Very little of this overflow land was suitable for cultivation in its original state. Levees were constructed to prevent the major rivers from overflowing and they now protect most of the area. The Mississippi River Commission, the Corps of Engineers, United States Army, and many privately financed drainage districts have built levees, the work extending over a long period of time. Since the disastrous flood of 1927 the Army engineers have been working on an adequate system of levees to hold back the flood

waters. These levees now protect most of these lands and afford better flood protection to people living in the area than they ever enjoyed before.

In leveed areas during floods, when there is danger of a major levee break, there is confusion comparable to a civilian population fleeing before an invading army. Roads are filled with refugees, some in automobiles, some in wagons, and some on foot, driving stock and carrying every conceivable kind of bedding and other household and personal belongings. In many areas in Arkansas, formerly subject to periodic floods and to evacuation, the new and adequate levees give a sense of security for life and property which is reflected in the confidence of the people, their willingness to build better homes, farm buildings, and all types of permanent improvements.

The conditions in this section of Arkansas are typical of a large area in the Mississippi Delta in Louisiana, Mississippi, and southeastern Missouri. The Bureau of Agricultural Economics has made studies of economic problems confronting new settlers in the area, as covered by United States Department of Agriculture Miscellaneous Publication No. 442, "New Settlement in the Mississippi Delta." This publication gives information relative to the economic problems of new settlers and discusses among other problems the credit needs, the dependence upon cotton, farm organization, the importance of flood control and drainage, and the need for a coordinated program of planning and action.

One of the needs of new as well as old settlers in this area is a farm conservation program. This program

would be somewhat different from the usual soil conservation program where erosion is the principal problem. In the Delta lands drainage is one of the principal physical problems. Erosion on the farm lands in the Delta is not as severe as on rolling lands but, even so, it is enough of a problem to justify practices which will reduce soil washing to a minimum. One of the most serious problems in Delta areas is the filling of ditches with erosion debris. In many instances fertile areas of drained lands have been abandoned because of drains filling at such a rapid rate that the farmers were unable to keep them clear. A proper farm conservation program, especially on critical areas contributing silt, and the proper design and construction of drainage drains with appurtenant structures and practices along the drain will reduce siltation to a minimum and thus contribute to the proper conservation and utilization of such land.

Farm drainage is one of the soil conservation practices most needed in the Delta—this is evidenced by the large number of wet spots in the fields and the spotty crops on most of the farms. Furthermore, improved farm drainage would contribute to soil conservation and improved crop yields on many farms even where the public drains are satisfactory.

The need for soil-building practices and the working out of proper crop rotations are among the other conservation problems that should be solved to secure a permanent soil conservation program. The problem of crop rotations is influenced by the dependence on cotton as the principal cash crop. The study reported in Miscellaneous Publication No. 442 has indicated that the average distribution of crops on a Louisiana new-ground farm is about 9 acres of cotton, 10 of corn, $1\frac{1}{2}$ of feed crops, 1 of truck crops, with a total of 24 crop acres. In checking the total acreage of crops in eight Arkansas counties on which I studied the Census figures, I found that less than one-fifth of the land that was used for cotton and corn in 1939 was devoted to hay.

The large community drains necessary to the proper drainage of the Delta so that farmers will have an outlet for drainage water from their farms were built by organized drainage districts. The drainage districts in Arkansas are largely within the Mississippi Delta and comprise 4,631,155 acres (1930 census) or an area almost equal in size to the whole State of New Jersey. These districts have constructed 5,000 miles of drainage ditches. They were nearly all organized between 1905 and 1924; two-thirds of the area was organized into drainage districts in the decade 1910 to 1919. Drainage districts in the Delta in Louisiana,

Missouri, and Mississippi comprise additional large areas having similar problems.

These drainage districts and the flood control works proved to be the foundation for one of the major and most significant land settlements in the history of the United States. The movement of settlers into the area is still under way and there is land available for more families. A recent estimate has indicated that there are still over a million acres of land not now developed in Arkansas which could be drained and farmed. Miscellaneous Publication No. 442 estimates that the portion of undeveloped areas that could be made suitable for agriculture in the Delta as a whole under proper conditions of development would supply 80-acre farms for about 62,500 families or 40-acre farms for about 125,000 families.

After driving some few hundred miles through this area in Arkansas I felt that census figures on population, agriculture, and drainage should reveal some interesting information on this land settlement. I selected eight counties for a study of the available information—Mississippi, Poinsett, Chicot, Craighead, Desha, Crittenden, Clay, and Green Counties. The reason for this selection was that these counties have the highest proportion of land in organized drainage districts, and because of this the county totals should reflect most adequately what is occurring in the drainage districts. These counties either adjoin or are in the second tier of counties from the Mississippi River. Their combined area is 3,630,720 acres, of which 2,580,978 acres are in organized drainage districts. The $2\frac{1}{2}$ million acres of drainage is a huge undertaking, and many of the most significant agricultural problems remain to be solved. In 1930 these drainage districts had a high proportion of unimproved land, including woodland and cut-over land. The census of that year listed 1,272,811 acres of unimproved land in these counties.

To get some idea of the extent of crop land being brought under cultivation, I compared the census figures for crop land harvested for the years 1929 and 1939. In the 10-year period there was an increase in the crops harvested of 323,403 acres. There is little doubt that practically all of this increase has occurred in the drainage districts. In the State as a whole there was little change in the crop land harvested between 1929 and 1939, the State totals for the 2 years being about 6,600,000 acres. This increase of about 300,000 acres in the eight counties is thus balanced by decreases in crop land harvested in other counties. In examining the county figures I observed that decreases in crop land harvested and in popula-

tion occurred in those counties where erosion is known to be particularly severe.

Soil conservation on a farm includes among other practices the retirement of eroding hill land which is too steep for continuous cultivation and shifting the cultivation to the least erodible part of a farm. In Arkansas a movement similar to this soil conservation practice is occurring on a State basis with many of the families actually abandoning eroded, worn-out farms and moving their few remaining belongings to the lowlands. The present movement is not true soil conservation because much of the hill land is destroyed before the family leaves the hill farm, and when the settler arrives at the lowland farm he may find poorly drained cut-over land, with little in the way of resources with which to develop land.

In general, the trends revealed by census information check with observations and statements of local people. The local people believe that numerous families are abandoning farms in other sections of the State and moving over to the lowlands. According to the 1940 population census, the rural population declined in 31 counties as compared with the 1930 census. In the 8 drainage counties studied the rural population increased by 28,977 persons during the decade, representing an increase of 12 percent in the counties. By comparison, the State increase in rural population was only 45,873 persons, or a 3.1-percent increase. The principal increases in rural population occurred in the counties with large amounts of drained lands being brought under cultivation and in counties adjoining urban areas such as Little Rock and Fort Smith.

Many people living in Mississippi County, the largest of the drainage counties, believe their land is endowed with unusual fertility. The principal crop is cotton, and the census reports that in 1939 this county produced 200,445 bales on 183,888 acres, or an average of 1.09 bales per acre. The yield for the counties in the drained area is far greater than the average yield of the State. We went over one drained farm in Mississippi County that yielded slightly over 2 bales of cotton per acre this year. We examined other farms where the yield has been seriously reduced because of poor drainage conditions. If proper drainage conditions could be established and farm conservation programs followed, this area would, without a doubt, become more prosperous and many more farms would be in the bale-and-a-half per acre class. The conservation program needed would include regular drainage maintenance and improvement, with proper



Plowing new ground.



Cotton growing among deadened trees.

soil-building practices so that high yields could be maintained.

Among the people with whom we talked in Mississippi County there is the impression that most of the settlers are small operators who are buying their farms. We were given a rather favorable picture of land-settlement conditions in Mississippi County—but more complete studies would be necessary to get all the facts, including the problem of meeting the debt payment. We were cited instances of farmers who came a few years ago with limited equipment and resources; some were described as “not having a dime.” To illustrate, uncleared land was sold in some instances for about \$25 per acre, with the settler contracting to clear reasonable acreages for the first few years and payments on principal not to start for 5 years. Many settlers who undertook deals of this kind have made excellent progress in clearing their lands of timber, in construction of farm buildings, and in maintaining their payments of interest and principal. We were cited instances in which the farm debt has been entirely paid. The Agricultural Census shows that in Mississippi County the number of farms operated by full owners increased from 873 in 1930 to 1,437 in 1940, and that there was a substantial decline in the number of tenants and croppers.

The 1940 Agricultural Census for Mississippi County reports on the mortgage indebtedness of a group of 556 farms operated by full owners who own no additional land. The average size of the farms in

this group was 73 acres, the average value \$94 per acre, the average equity per farm \$4,394, the average debt per farm \$2,395, or \$33 per acre, and the average interest rate 5.6 percent. The average debt in the county is high compared with the State average, but it is much lower than the 1930 debt and the interest rate is lower.

Although most of the Delta is fundamentally good land, is being developed, and offers a fine opportunity for many new homes, the national or State problems involved in the settlement and maintenance of the areas should not be overlooked or minimized. United States Department of Agriculture Miscellaneous Publication No. 442 gives a picture of the hardships and difficulties of new settlers of the Delta. It was found that many settlers lacked advance information about the adaptability of their soil to agriculture and the drainage and flood problems. One settler in seven is losing or abandoning his farm after the first year or two of work, and many others are threatened with such losses. High prices for land,¹ unfavorable terms of occupancy and purchase, poor land drainage, and lack of guidance in selection of farms for settlement are problems which contribute to insecurity and weaken the system of small home ownership.

Although the agriculture in these drainage counties is undergoing a healthy growth as evidenced by information previously cited, the brief study that has been made emphasizes the importance of the many soil conservation problems requiring solution. Many of the main drainage systems have deteriorated and extensive rehabilitation work must be accomplished before proper land drainage can be secured. There is need for extensive improvement in farm drainage practices. It is believed that one of the most effective

ways of helping this area would be to provide better land drainage and thus improve the earning power of farmers. With good drainage, excellent crops can be grown; with poor drainage, the economic conditions will become worse. By the application of proper farm conservation programs, including improved drainage, soil fertility can be preserved and improved. A complete conservation program embracing these and other necessary practices would be particularly helpful in assisting new settlers to succeed and become home owners.

POOLING EFFORTS

(Continued from p. 182)

County Highway Department. Loaned snow fence for nursery. Furnished trucking service.

Chamber of Commerce. Publicity.

Soil Conservation Service. Assisted district in preparing soil conservation plans for district cooperators. Furnished trees for erosion control. Assisted district in revising and carrying out program of work.

Civilian Conservation Corps. Made CCC camp labor available to district.

Extension Service. Educational program.

State Department of Conservation. Furnished trees for public lands. Gave technical advice on reforestation, fish and game problems.

Grand Haven Public Schools. Furnished movie for educational meetings.

Grand Haven Tribune and Muskegon Chronicle. Assisted by giving public news of activities of the district.

Telephone Company. Donated tree trimmings for brush mulch instead of burning as in the past.

EROSION CONTROL ON LAKE MICHIGAN'S CLAY BLUFFS

By B. A. MYERS¹

FRUIT and truck crops give southwestern Michigan a multimillion-dollar industry, thanks to suitable soils and a prevailing wind that sweeps eastward across Lake Michigan to temper the climate exactly to the liking of tender peach and apple blossoms. These same winds bathe the beaches along west-coast Michigan, inviting hundreds of thousands of tourists, creating for lake-shore residents another multimillion-dollar business every summer.

Fine summer homes, thousands of them, have been built along the lake. They nestle among the sand dunes and, unfortunately, sometimes those wind-worn dunes nestle right down over these summer homes, burying them in enormous sand drifts. As the wind blows, so do the waves roll. When the winds are high, the waves charge landward, bouncing with tremendous force against towering bluffs, trees, wharves, harbors, highways, and houses.

Thus, one of the problems along this lake is the so-called "lake-shore erosion"—either wind erosion or

¹ Project engineer, Ohio Valley Region, Soil Conservation Service, Benton Harbor, Mich.

water erosion, the latter caused by intermittent wave action which often damages homes, valuable horticultural land, parks, city property, expensive highways.

In an effort to demonstrate what could be done to control this lake-shore erosion, the Soil Conservation Service, in cooperation with the Berrien County Highway Department, established, in 1938, six demonstration plots near Benton Harbor. These plots have successfully passed through two winters and a severe lake storm—one of the worst in the last decade, the storm of November 11–12, 1940.

Especially significant is the fact that already public officials are convinced of the efficiency of the methods employed in the demonstration plots, and they are effecting similar erosion control work on other sections of the lake bluff.

Before discussing the control methods used on the six plots it may be well to give a clearer picture of the problem faced by the technicians in charge.

The bluffs are composed of unweathered glacial drift of a clay nature. They erode easily. The bluffs occur in alternate stretches with sand dunes along the entire eastern shore of the lake. Undoubtedly, in times past they have receded a great distance.

Erosion on these bluffs occurs in cycles. Periods of accelerated erosion closely follow the storm cycles of Lake Michigan. Records of lake storms during the past 60 years show that those severe enough to cause undercutting at the toe of the bluff occurred in periods of 14 to 16 years.

Undercutting by the waves is serious because of the clay nature of the bluff material. This material, when exposed to alternate freezing and thawing, is susceptible to considerable heaving and slipping and, since the most severe storms on record have occurred in the fall of the year, the undercutting frequently causes the entire vegetated surface of the bluff to slip during the winter months.

If no control measures are put into effect, the scars left from the slipping are enlarged by increased frost action until the bluff assumes its natural angle of repose. Eight to ten years is probably the shortest time required for this to occur, depending on the severity of the undercutting and on the vegetative covering. This leaves approximately 5 or 6 years for natural revegetation to take place before the bluff is again undercut and the entire process is repeated.

To demonstrate control measures under varying conditions such as slope, seepage, and amount of native cover, a demonstrational area 500 feet long was subdivided into six plots. Natural boundaries were used so that the area enclosed was as nearly uniform as possible.

In addition to the six plots covering the face of the bluff proper, a strip of beach 50 feet wide and extending along the toe of the entire bluff project was used as part of the demonstration. The problem involved on this strip was to develop a vegetated foredune which would give to the base of the bluff both mechanical and vegetative protection from wave action.

On plot 1, the principal method by which vegetation was established consisted of seeding a mixture of grasses and legumes at the rate of 100 pounds per acre and mulching with marsh hay at 4 tons per acre. The mulch was held in place by used woven wire which was fastened to the ground by stapling it to live willow stakes driven 12 to 18 inches into the ground. A small diversion channel was constructed at the top of the plot area to divert storm water from the face of the plot into the highway drainage system. A post and wire dam was built on the contour across the toe of the slope. This was a living dam consisting of willow posts faced with woven wire, willow brush, and straw. The plot was planted to shrubs and trees, the upper one-third to coralberry, chokecherry, and gray dogwood; the middle third to red osier dogwood, lilac, and caragana; and the lower third to black locust.

Plot 2, which had a fair covering of native grasses, was left as a check area to determine the effectiveness of this cover as well as the extent to which shrubs and trees from the other plots would spread through natural reproduction. Barren areas were seeded and mulched in the same manner as described for plot 1.

Plot 3 included a large seep area which required the use of a mechanical drain to assist vegetation in becoming established. A 6-inch, 18-gage, perforated culvert pipe was installed for this purpose. Because the upper part of the plot was very steep, a system of contour wattles was used on the upper one-third. These wattles were constructed by digging a trench 8 inches deep and 12 inches wide to form benches 3 feet apart on the contour. Shrubs were then planted on the benches to form level living dams. This area was seeded at the rate of 50 pounds per acre. The contour wattles were mulched with marsh hay at the rate of 4 tons per acre. All other raw areas on this plot were likewise mulched and seeded, by a method similar to that used on plot 1. The contour wattles on the upper one-third of the plot area were planted to a mixture of gray dogwood, chokecherry, and coralberry. These were spaced 18 inches apart in rows on the contour benches. The remainder of the plot was planted to black locust.

To demonstrate the use of various types of mulching materials in establishing vegetation, plot 4 was divided into two parts. Corn stover at the rate of 3 tons per

acre was used on one, and chopped brush on the other. Both materials were fastened down by used woven wire and willow stakes. Contour wattles were built across the lower one-fourth of this plot because of numerous shallow gullies. They were built similarly to those on plot 3, except that willow stakes 12 inches apart were driven in the edge of the benches. After seeding, the wattles were mulched with marsh hay at the rate of 4 tons per acre. The upper third of the plot was planted to coralberry and American hazel; the middle part to red osier dogwood and arbor vitae; and the lower third to redbud and mountain ash.

When work was started on plot 5 it was barren of vegetation and the top half of the plot was vertical. Wave action had been more severe than on any other plot in the demonstration although frost action was less severe. Erosion was no doubt held in check by the growth of vegetation above the plot area, but inasmuch as no seepage was noted on the plot it is believed that the absence of this factor greatly reduced erosion from frost action. This plot, because of its barren and steep topography, made the problem of controlling erosion extremely difficult.

Because plot 5, as well as plot 6, was subject to wave action, a railroad tie cribbing was built across the toe of the slope on half of plot 5 and half of plot 6. The vertical faces of the upper parts of these plots were sloped back by blasting and hand labor to an average grade of 75 percent. This grading made fills which covered the lower halves of the plots behind the cribbing to a maximum depth of 6 feet.

On plot 5, five post and board dams were built across the plot on the contour, averaging about 12 feet apart. These dams were used in an attempt to hold the loose fill dirt in place and were constructed as living dams by placing used boards, willow brush, and marsh hay above willow posts. The entire area was seeded at the rate of 75 pounds per acre. Fine brush was used as mulch. The upper half of the plot was seeded to chokecherry and planted to coralberry, caragana and American hazel, and the lower half to caragana and black locust.

In an attempt to effect stabilization of the large amount of fill dirt in plot 6, contour wattles were used over the entire area. A trench approximately 8 inches deep was dug and the dirt taken from it was used to form a ridge along the lower side of the wattle. Then 24-inch willow stakes were driven 18 inches into the ground, 18 inches apart on the ridges. The trenches were packed with willow brush and cuttings and loose dirt. The maximum horizontal spacing between these contour wattles was 4 feet. The plot area was seeded at the rate of 75 pounds per acre and mulched with

marsh hay at the rate of 4 tons per acre, except the southern quarter of the plot area, which was left as an unmulched check strip. This practice was supported by a pole-and-brush dam built across the base of half of the plot area. This living dam was constructed by placing willow poles 2 to 3 inches in diameter horizontally in front of willow posts.

The upper half of the plot was planted to buffalo-berry, coralberry, caragana, Japanese barberry and chokecherry seed, and the lower half to black locust and caragana.

Protection against wave action is of utmost importance. The success of the stabilization work carried out on the face of the bluff depends directly on beach protection. A permanent mechanical revetment or cribbing would control wave action completely but the cost would be too great to be economical under average conditions, even though the element of chance does enter into a vegetative control program.

Briefly stated, the stabilization measures used for the control of wave action at the base of the plots are, (1) the planting of a tree and shrub belt 20 feet wide along the base of each plot, (2) the use of living dams at the base of plots 1 and 6 and (3) the combination of vegetative and mechanical control by the use of railroad tie cribbing at the base of plots 5 and 6.

In addition to these measures, a snow fence 4 feet high was set up 50 feet from the toe of the bluff, paralleling the entire length of the project. This fence was to serve a two-fold purpose: First to build a foredune; and second, to keep the public off the project. To speed up the development of a foredune and to fill this dune with a mass of soil-binding roots, an area 40 feet wide extending from the tree and shrub belt to approximately 7 feet beyond the snow fence was planted to American beachgrass in the fall of 1939. This beachgrass was planted in nets, one net consisting of a square 6½ feet on a side. From 5 to 10 tufts were planted inside each square.

Of the various methods used in attempting to stabilize erosion on the clay bluffs, the most outstanding are these: First, the *use of mulching materials*, such as marsh hay with woven wire and willow stakes to hold it in place. To date this method has given the best stand of vegetation and the best control; 10 to 20 percent of the willow stakes have survived and made excellent growth. Corn stover and brush mulch have not worked so satisfactorily. Second, the *use of living dams*, such as the willow post, woven wire, and willow brush dam. Although the willow posts have not survived, the brush used behind these dams has made excellent growth and the dams are truly living barriers.

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Compiled by **ETTA G. ROGERS**, Publications Unit



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¹ Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

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Land for More People in the Mississippi Delta

By JOHN G. SUTTON¹

Recently while studying drainage conditions in northeast Arkansas I was impressed by the extent of cut-over land that is being cleared; by the large number of new settlers who have moved onto their farms; by new buildings, and by the rows of cotton and corn running in between the deadened trees and partially burned stumps. Not all of the land development is new—much of the land, particularly along the higher ridges, has been farmed for a long time. The older mainly traveled roads run along the ridges, and one must travel the back roads through the lower lands to appreciate the extent of recent land development. In this section of Arkansas are to be seen unusual contrasting pioneer and modern conditions: log cabins from native logs, surrounded by partially cleared (Continued inside on p. 203)

¹ Head of Drainage Section, Engineering Division, Soil Conservation Service, Washington. D. C.



MARCH 1942

MEETING
THE NEEDS
OF WAR



SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Men, Soil, and Equipment are answering the National Colors. "Food for Freedom" is more than a phrase—it is the practical objective of the main agricultural drive. Read Glennon Loyd's article, "Selective Service for Each Acre." Also, "Farm Planning for War Needs" and "Mobilization of Service Equipment for Civilian Defense."

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

Selective Service for Each Acre:	Page
By Glennon Loyd.....	209
Mobilization of Service Equipment for Civilian Defense:	
By G. E. Ryerson.....	211
The CCC Marches On:	
By G. H. Gilbertson.....	212
Bulldozers and Grade A Milk:	
By A. T. Semple.....	215
Ups and Downs of a Wyoming Ranch:	
By A. E. McClymonds.....	218
What of the Western Front?	
By Frank Kimball.....	223
Michigan District Grows Millions of Trees.....	227
Fields Plowed in Beds for Drainage.....	227
War and Soil Conservation:	
By Angus McDonald.....	228
This Stockman Believes in Soil Conservation Districts.....	230
For Reference:	
Compiled by Etta G. Rogers.....	Opposite 232
Farm Conservation Planning for War Needs:	
By E. H. Reed.....	Back Cover

Front and Back Covers
By Katherine R. Johnson

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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SELECTIVE SERVICE FOR EACH ACRE

BY GLENNON LOYD ¹

A MINNESOTA farmer would not think of launching his food for freedom program to increase milk production by placing his herd on an exclusive ration of foxtail hay. Nor could he expect to meet his patriotic pledge if he suddenly adopted a policy of whacking Old Bossy with his milk stool every time she switched her tail.

And, strange indeed would be the Iowa corn-hog farmer who would contemplate expanding his pork production by saving only the runts of the litters for breeding stock, and letting them rustle acorns.

On the contrary, the Minnesota farmer is contributing his full share to victory by thoughtful care and more balanced rations, and the Iowan is selecting his seed stock for his swine expansion with an eye for efficiency in converting corn into pork.

But from a soil conservation standpoint, these same farmers may unwittingly starve their acres, abuse their land and go about increasing wartime crop production in a clumsy manner.

Thus the Soil Conservation Service has its job in the tense emergency laid out. It is the United States Department of Agriculture's watchdog of the land's fertility and productivity, as the Nation's farmers willingly put aside their "farming as usual" blueprints and whip up production of pork, eggs, milk, and certain other products.

The sound conservation in which the Service has assisted thousands of farmers, on millions of acres, supplies the specifications for accomplishment of agriculture's task without placing a needless strain on the soil. The present emergency calls for each farmer to set up a "selective service system" for each acre of his place because proper use of the land is the first funda-

mental of soil conservation. It also means that farmers must not repeat their World War I mistake—wanton plowing and cropping of every nook and cranny on the farm. Fortunately today we can benefit by our past experience and increased knowledge of soil conservation to take prompt and effective action to expand production without wasting our soil.

The farmer who has a complete soil conservation plan based on capabilities of the land is in a preferred position for he already has his "selective service" work done on his acres. He knows how intensively he dares crop any piece of land, and how to avoid the ravages of erosion or depletion of fertility. He knows which fields are productive enough to grow an extra year of corn in the rotation, if necessary.

Unfortunately, we cannot muster soil surveys and land use capability maps for every farm in the country overnight. Our greatest contribution necessarily must be through assisting farmers, on a Nation-wide basis, in the adoption of simple and easy-to-install soil conservation practices based on sound land use.

Wiser use of land, contour farming on slopes, and pasture improvement can be put into effect by almost all farmers this spring of 1942. These practices, quickly established, will help greatly in accomplishing our goal—increased production without further draining of soil resources.

Proper use of the soil means that intensive production of grain and cultivated crops must be confined to level and gently sloping land. Land too sloping for safe cultivation, or subject to serious erosion, can be used most advantageously for hay or pasture, our cheapest sources of feed.

Permanent pasture or trees should be the only crop on seriously eroded, steep, or poor sandy land and unproductive soils. Some steep grassland, if not cut

¹ Head, regional current information section, Soil Conservation Service, Milwaukee, Wis.

or grazed too closely, can be used for hay or pasture. We can do one thing to help permanent pastures get started off on the right foot this spring—in all instances, permit them to make at least a 4-inch growth before turning in the stock.

Pasture improvement is another step we can take to produce immediate results and carry lasting effects. A complete job of pasture renovation includes these steps: thorough working up of the old sod as soon as the frost begins to disappear; liming; fertilizing where needed; reseeding with legumes, restricted grazing until the seeding becomes well established. This probably will cost around \$8 per acre, but it generally doubles or triples the amount of pasturage and, with proper management, the job lasts from 5 to 8 years. Clipping weeds at blooming time and using manure on pastures—covering as many acres as possible each year—are two other proved practices farmers can use to help boost pasture output.

In this Upper Mississippi Region the following suggestion is being issued to farmers, in a printed statement, Produce Food for Freedom, through the county and State Defense Boards of the United States Department of Agriculture:

Lime, if needed, to grow alfalfa or sweetclover; disk or spring-tooth thoroughly on the contour; seed a legume-grass mixture before grain-seeding time in the spring; pasture legume mixtures after they are 8 to 12 inches high—then practice controlled grazing, leaving several inches of growth in the fall; use supplementary pastures to relieve permanent pastures. Second year sweetclover should be grazed heavily early in the spring.

To conserve cropland while producing, the Produce Food for Freedom suggestions are as follows:

1. Improve your soil by liming acid soils, using commercial fertilizer where its application will economically increase yields and improve quality; seedings sweetclover for green manure in all grain on nonacid or limed soils where corn is to follow the next year; applying barnyard manure and returning cornstalks, stubble, and other crop residue to the soil.

2. Install soil conserving rotations because they are the most profitable. Use rotations containing 1 or more years of grass-legume meadows, keeping in mind that steeper slopes or less productive soils yield a larger total if in hay or pasture one-half or more of the time.

3. Hold soil and water on the hillsides by contouring the crop lands subject to erosion, or using rotations

with more hay and pasture on land where it is not practical to farm on the contour. Contour strip crop where practical. Where more control is needed than is provided by contour tillage or strip-cropping, terrace long slopes up to 10 percent on which adequate terrace outlets are available or can be constructed.

4. Grow soybeans only on land not subject to erosion. On sloping soil soybeans should replace corn rather than grain in the rotation and should be grown on the contour. Wherever possible, follow soybeans with a winter crop such as winter wheat or rye.

5. Prevent wind erosion by planting at right angles to prevailing winds; leave field rough and leave some trash to prevent soil blowing; use field strips 10 to 20 rods wide on soils that blow; and plant at least 4 rows of corn for every 20 rows of potatoes, and leave corn standing over winter.

Farmers generally can reduce the requirements for commercial protein feeds, for both hogs and cattle, by expanding acreage of legume pasture and hay. In addition to being high in protein, legumes ordinarily yield a greater tonnage per acre than most other pasture seedings and, in addition, require less labor per unit of feed, compared with cultivated crops.

An Iowa farmer, V. Loy of Bedford, made this remark to R. G. Bullard of the Taylor County (Iowa) Soil Conservation District staff: "In 1941 my alfalfa field produced more pork than an equal acreage of corn and a hay crop besides." This experience convinced Loy that he can get greater production of pork by substituting alfalfa for part of the corn in hog feeding. Raymond Meissen, Illinois farmer near Durand, said that the 81 pigs he had on a field of alfalfa last year made more rapid gains than any he had raised before. The only difference in feed and management was the clean alfalfa field.

There is no necessity for bleeding the remaining topsoil from our hills; nor is there any excuse for removing what is left of the precious fertility from our other less productive acres. We have the skill and the tools to get this job done and we must redouble our efforts immediately so that the thousands of farmers who have solved their erosion problem can get at the work of spreading the gospel of soil conservation.

If we do our part there will be little need for farmers to call gully scarred or wounded acres to the front lines of this food for freedom production campaign. We do not want new gullies, or any additional erosion-scarred fields, after the campaign is over and the food for freedom program is an accomplished fact.

MOBILIZATION OF SERVICE EQUIPMENT FOR CIVILIAN DEFENSE

BY G. E. RYERSON¹

EMployees of the Soil Conservation Service are to have another opportunity to assist in the War effort—we are to have the privilege of contributing our time and energy to mobilize Service equipment for defense of the civilian population.

The Department of Agriculture has more equipment of widely diversified types than any other civilian branch of the Government, and our Service is one of the largest users of equipment in the Department. Soil Conservation Service equipment consists of all types of transportation vehicles, tractors, earth-moving machines and tools, pumps and other materials, and supplies. It can be of tremendous value to the country if it is organized and mobilized so that it, along with operating personnel, can be used to repair damage and alleviate suffering in bombed or otherwise stricken areas.

A certain memorandum of authority (Secretarial Memorandum No. 961) provides for the mobilization of Departmental equipment “so that it may be used in an orderly and efficient manner to render aid to the extent of its capacity in any needs of civilian defense.” A Departmental Equipment Mobilization Committee has been established to “effectuate this policy and to expedite the organization” of equipment. The Washington committee is composed of one member from each of the Bureaus of the Department operating any substantial amount of equipment.

Provision is also made for the establishment of Regional United States Department of Agriculture Equipment Mobilization Committees to serve in the Civilian Defense Regions, which are identical with the Army Corps Areas rather than the regions of the Soil Conservation Service. The responsibilities of the regional committees will be as follows: (1) to mobilize and organize the Department equipment resources in such a way that they will be of the most value to the public in the event of an emergency; (2) to carry out this mobilization and organization in such a manner as to minimize any interference with the normal activities of the Departmental agencies; and (3) to take action to effectuate and coordinate the operation of the program when emergency conditions prevail. It is expected that the program to be developed in accordance

with this broad policy will be particularly valuable in providing assistance to the rural areas that otherwise might not have adequate facilities for protection or relief if subjected to bombing.

In carrying out our responsibility under this policy, we of the Service, in conjunction with the other Bureaus, must first determine what usable equipment in virtually all categories can be made available for emergency use without serious disruption of permanent installations or interference with any program vital to the prosecution of the War efforts. After this survey has been made, and the equipment is located and classified, we shall then organize it into individual units, and furnish each unit with whatever tools, supplies, etc., may be necessary for the greatest possible protection or relief to the particular area that may be served. Service personnel will, of course, be trained in the operation of these civilian defense equipment units, and will be assigned for emergency duty in such a way that assistance can be rendered on a continuous basis.

In developing an organization such as this, many details have to be anticipated and provided for in advance since the circumstances under which such units must operate nullify any possibilities of obtaining emergency repair service or supplies. Furthermore, in the development of plans it must be kept in mind that we may be called upon to operate in conjunction with any one or all of the six divisions of Civilian Defense, namely, the Fire Department, Police Department, Wardens Division, Medical Division, Public Works Division, and Utilities Division.

There is, of course, no definite idea at this time as to the form the field organizations may take, since it is recognized that operating divisions of the different Bureaus vary widely throughout the country. It is expected, however, that the personnel will be asked to effect an organization that will accomplish the purpose outlined, in addition to fulfilling their regular Soil Conservation Service activities.

The plan of operation that has been developed and already put into effect at the Albuquerque, N. Mex., regional headquarters is being cited as an example of what can and should be accomplished. An outline discussion of some of the units developed and their intended purpose is given in the following:

¹ Head, equipment section, division of engineering, Soil Conservation Service, Washington, D. C.

FIRE FIGHTING UNIT

Personnel.—1 Leader or Chief, 1 Driver, 6 Firemen. All of these persons are qualified as drivers, fire fighters, pump men, and in demolition work. Three of them are qualified in first aid.

Equipment.—This unit consists of a 2-ton truck on which is mounted the following:

- a 400-gallon water tank.
- 21½" centrifugal pumps, connected in series.
- 250' 1½" fire hose.
- 30' Suction hose.
- 6 Foamite fire extinguishers (3-gallon capacity).
- 6 Pyrene fire extinguishers (1-quart capacity).
- 1 3-KW light plant.
- 4 Fire axes; bars, shovels, wrenches and necessary small tools.

Purpose and use.—This is, in effect, an auxiliary fire wagon. The pumps can take the water from the 400-gallon tank, from a city fire plug, or from an open ditch or pond. The truck is equipped with flood lights for use where light is needed.

REPAIR AND DEMOLITION UNIT

(Welding and Cutting)

Personnel.—1 Operator, 3 Assistant Operators.

Equipment.—This unit consists of a 1½-ton truck on which is mounted a 300 amp. Wildcat electric welding machine. This welding machine has an AC generator that furnishes power or lights for the job. Tank of oxygen and acetylene, welding, and cutting torches, with hose, bars, hammers, clamps, and chain pulls or come-alongs of 1½-ton capacity.

Purpose and use.—This unit can be moved very rapidly to any location for emergency repairs as needed, or where metal obstacles, such as light poles, beams, girders, etc., should be cleared away. The cutting torches can be used to cut metal obstructions, destroy barbed wire entanglements, or other obstacles. The electric welding machine can be used for quick emergency repairs to water mains, gas mains, damaged girders, bridge structures, or for reinforcing other types of emergency equipment.

PLANT UNIT

Personnel.—1 Warden, 2 Watchers, 1 Service and Supply Sergeant, 1 Desk Sergeant, 2 Guards, 1 Alternate Driver and Mechanic, 1 Messenger, 1 Communications and Contact Man.

Purpose and use.—This unit is set up to protect materials, buildings, and equipment, and to facilitate the handling of materials and supplies needed during emergency, or by any of the portable units working from this station. The personnel would watch for and report fires, raids, or other unusual activities; keep records of the location of the various portable units that might be in the field and answer the requests from those units for extra materials and supplies, using the messenger and communications personnel to make the contacts.

MOBILE ELECTRIC GENERATOR UNIT

Personnel.—1 Operator, 1 Assistant Operator.

Equipment.—Pickup-type truck on which is mounted the following: 1 or 2 gasoline driven 2 KW or 3 KW electric generators; 400' of No. 10 rubber-covered wire; hand tools and miscellaneous supplies.

Purpose and use.—This unit can move rapidly to any location where a small amount of power or lights is needed. This equipment is a 110-volt DC, and almost all standard electrical appliances and lights could operate from these generators. They would be particularly useful in lighting hospitals, work locations (headquarters), telephone exchanges, or other important locations that must carry on operations even during a major failure of power lines.

It is expected that the organization of the regional committees will take place rapidly after Departmental policies are thoroughly defined. The first organization of these committees will be in the Coastal areas. Work in the central parts of the country probably will be deferred until some experience is gained in those regions which will be going into operation in the near future.

THE CCC MARCHES ON

BY G. H. GILBERTSON ¹

THE BIRTHDAY celebration of the CCC on April 5, 1942, will be strictly a long pants affair. In nine brief years, the Civilian Conservation Corps has passed the swaddling clothes stage, outgrown its schoolboy era, and now, doing a man's job, takes its place among the adult agencies of the Government.

In its babyhood, the CCC was probably regarded by many people as an agency to provide work for unemployed boys. In its maturity, these same people will think of the Corps as a labor battalion which is making a highly important contribution to urgent and essential defense work.

In its tenth year, because of war needs, the CCC's work program is changing. CCC companies are being

summoned from the fields, parks, and forests to assist the armed forces, not as combatant troops, but as a civilian labor corps, with experienced foremen and technicians, participating in construction and maintenance programs of military and strategic importance.

This role for the CCC is not entirely new. At the beginning of the defense program, a few companies were assigned to military forts and reservations to help complete part of the great task involved in expanding the military posts to the size needed to train the new army. Others were put to work building recreation camps near cities for the housing of soldiers on week-end leave. These undertakings met with such widespread approval that the War Department asked the CCC Director to reassign more CCC companies for similar work.

¹ Information division, Soil Conservation Service, Washington, D. C.



Hundreds have been called to the CCC from farms, forests, and parks, to assist with work of military and strategic importance. This crew, under Army direction, is clearing a parachute troop landing field on a military reservation.

Ordinarily it might be expected that some opposition to this request would come from conservation agencies cooperating in the CCC program. Their work, such as protection of forests against fires and of fields against soil erosion, has an increased importance in the war program. Uncontrolled fires—a “natural” for saboteurs—not only can cause tremendous losses of the timber needed for war production, but also can destroy communication lines, interrupt transportation, or even interfere with the identification of enemy planes by clouding the skies with smoke.

Likewise, the soil conservation work takes on new importance in the program for increased production of food needed by the Nation and her allies. If the errors that accompanied increased production during the last war are not to be repeated—if the post war consequences are not to be another cycle of “black blizzards” and a tremendous loss of productive topsoil—this increased production must be achieved through farm practices that will both protect the soil and yield the essential fats, oils, and food stockpiles.

These—protection against forest fires and against soil destruction—are programs in which the CCC has assisted by providing the labor needed to swing them into action. Yet, important as they are, the conservation agencies recognize that military needs constitute first priority in wartime.

It is entirely probable, however, that all of the CCC companies now doing conservation work will not be needed immediately or simultaneously for military assignments. Thus it can be expected that enrollees will continue to help carry on conservation programs contributing to the Nation’s wartime needs. Meanwhile, under a recent agreement with the Red Cross, in possible disaster relief work the Corps’ mobile

organization is “on call”—in emergency the entire resources of men and equipment of the Corps can be mobilized on a moment’s notice. In the past, the work of CCC enrollees during floods, blizzards, and hurricanes has been a potent aid in disaster relief work. Trained in first aid, experienced in the protection of lives and property, CCC enrollees can be a big help in war-caused disasters.

CCC enrollees working on military reservations are supervised by their regular technical service personnel, although now the work they do is planned by the military branch. This work is varied, but in general the jobs are akin to the tasks the enrollees ordinarily accomplish on their conservation assignments. Some are building target ranges, others are stringing telephone lines to artillery ranges. Still others are clearing landing fields for parachute troop-practice. Enrollees who have worked on forest projects know how to undertake the protection of timber stands on military reservations so that fires that may be started by saboteurs cannot endanger cantonments or destroy valuable training areas.

Erosion-control work is another important CCC job on military reservations. Time was an all-important element in constructing accommodations for the training of selectees. Other jobs had to wait. To build barracks and cantonment grounds to meet military specifications, it was sometimes necessary to level off slopes and to disregard, temporarily, the consequences of soil erosion.

But now erosion has become a pressing problem. Bald spots must be revegetated. Drainage systems must be constructed and protected against silting. Hurriedly constructed roads must be guarded against wash-outs and sloughing; this requires sloping the cut

banks and protecting them with vegetation. These are jobs that must be done as quickly as possible—not only to solve an immediate problem, but to prevent the greater subsequent damage that will result if the control work is delayed.

In doing this work the knowledge and experience of the camp technicians and foremen, as well as the skills developed by the enrollees, are useful. The techniques of the jobs are not new—only the locale. In employing these techniques and skills there is no essential difference between building a diversion outlet on a military reservation and within a soil conservation work area. Thus the armed forces, in selecting the CCC to do these noncombatant jobs of military importance, find the Corps a trained labor battalion already organized, equipped, experienced, and staffed with qualified technicians and supervisors.

Under the new work program, the same technical and administrative agencies participate in operating CCC camps. As before, if at any time it becomes desirable, the full facilities of the Corps, aided by its cooperating agencies, could still be utilized for improving the health of under-par selectees whose defects would be benefited by outdoor work and medical at-

tention. Furthermore, with the CCC a going concern with experienced personnel and equipment on the job, the Corps would be available, should Congress desire its services, for an important role in the post-war adjustment period, using its facilities and the available manpower to continue the Nation's efforts to balance her national resources budget.

The need for continuing the conservation programs, to which the CCC has contributed so materially, is by no means over. The Nation is still on a declining resources base. The downward trend has been bent; not reversed. Recent surveys indicate that on the basis of present programs there are 3 billion man-days of constructive work ahead for the Department of Agriculture alone. This is work that can be wisely invested in the future of the country, work young men can do, and work that will contribute to their health, morale, and job training.

In 9 short years, the CCC has done a big job. It has provided work for 2½ million unemployed young men. It has utilized the manpower to help to protect and preserve the resources upon which the Nation now must call. It has built up the enrollees physically,

(Continued on p. 222)

These days never came back—thanks to the CCC. The corps gave youth a chance to do productive work, taught them skills, utilized them to improve the Nation's natural resources.



BULLDOZERS AND GRADE A MILK

By A. T. SEMPLE¹

IT is increasingly apparent that grassland farming is especially well adapted to the New England and North Atlantic States because of the limited acreages of land suitable for cultivation and the huge market for fresh milk. In order to meet these conditions farmers grow as large a percentage of their roughage as is possible and ship in from the West grain and other concentrates to supplement their roughage. They have found, furthermore, that pasture is their cheapest feed during the growing season; and that the most practical and profitable procedure is to use for silage and hay whatever quantities of grass are not needed for pasture.

In choosing between hay and silage, farmers of the Northeast have found that while silage in general is a more expensive feed than hay, nevertheless there are times, especially the first cutting of grass, when weather conditions make it very difficult to put up hay satisfactory in quality. Consequently, it has become quite common to use the first cutting of grass for silage and subsequent cuttings for hay, while throughout the growing season care is taken to see that the cows have all the grass they can consume as pasture.

Most farmers using grass silage also use corn silage, and some feed them alternately each day. The level-est land is used to grow corn for silage—and on such land the cost is the lowest per ton for any silage. Much of the land used to grow grass for silage is too steep to be used often for corn. At Hampshire Hills Farms in Hillsboro County, N. H., W. P. Whiting reports that grass silage from the hills costs \$5 per ton. His corn silage from a valley field cost \$4.50 per ton, but from the hills it would cost \$8 per ton.

Some farmers thought when they went into grassland farming that they would be able to dispose of their plows, but they were convinced that this is not feasible. One farmer, Victor Close, of Long Lane Farm, Fairfield County, Conn., has a pasture consisting principally of Ladino clover which in 1938 produced 4 tons of milk per acre with only a light feeding of grain—approximately 1 pound of grain to 6 or 8 pounds of milk. The next year this pasture produced only about half as much milk. Kentucky bluegrass had so completely crowded out the Ladino clover that Mr. Close found the pasture almost useless for milk production and since 1939 he has been using it for dry



A span of mules mowing small grain which is put in the silo with alternate layers of clover.

cows. As a result of this experience he knows that he must plow it up in the spring and plant oats and Ladino in order to restore its productivity. Incidentally, his grass farming is rapidly healing a waist-deep field-long gully caused a few years ago by excessive plowing. Mr. Close freely credited the staff of the College of Agriculture and the Storrs Agricultural Experiment Station of the University of Connecticut with all he had learned about the use of grass in converting the abandoned fields of a few years ago into a highly productive farm.

About 1929, Floyd Verrill of Middlesex County, Mass., began building pastures. Before that time he had kept his cows in the barn the year round and plowed and cultivated his land regularly to produce crops to be hauled into the barns. Up to that time he had been about breaking even. Now, after 12 years, he has practically all his tillable land in grass; he has stopped raising corn and plows only enough to renew his pasture; and he claims, in his own words, to be "making a dollar now and then." He summed up the situation by saying that he had found out he could no longer afford to plow his land for the production of feed crops, yet he must use it more intensively. At his home farm he is keeping 60 head of cows on 35 acres of tillable land. In addition to pasture this acreage supplies first-cutting grass for silage and later cuttings for hay. One $3\frac{7}{10}$ -acre pasture of Ladino, with some grass and other clovers seeded in August 1940 without any nurse crop, carried about 24 head of cattle as a day pasture for most of the summer. He plans to plow up such pastures for renewal about every 6 years.

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A well-trained team of horses following a windrow made by an attachment on the mower and loading clover alongside the grain field.

One of the most important factors in connection with grassland farming in the Northeast is the reduction in labor costs and labor peaks. H. E. Babcock of Larchmont Farms, Tompkins County, N. Y., has gone a long way in solving the farm labor problem by extending the harvest season over 4 months—June to September. Thus he has eluded the pressure of planting a corn crop in the spring and getting it into the silo in the fall.

By using horse power, and the least expensive equipment practical for any ordinary farm, two men and a boy put up grass for silage as rapidly as it is ready for silage making—the boy does the mowing and helps with the other operations when he has time. One man works at the silo while another, using a team that is trained to follow the windrow, is loading and hauling in from the field. The grass is loaded on a wagon with a hay loader and dumped on the ground at the silo. The silage cutter is set down in the ground so that practically no lifting of the green material is required. A man standing on solid ground feeds the silage cutter much more readily than he could were he standing on a loaded wagon. As weather permits, this same crew can put up a considerable quantity of hay, and this further reduces the labor of harvesting, storing, and feeding the grass crop. At Larchmont, grass silage is used for growing and fattening hogs, poultry, and beef cattle.

Regarding the selection of forage plants for grassland farming there is great diversity of opinion, and many experiments are being carried on both by experiment stations and farmers to determine the best mixtures of grasses and legumes. On one plant practically everyone is agreed—that is Ladino clover. Opinions vary considerably, however, as to how it should be used. At the Beemerville substation of the New Jersey Agricultural Experiment Station, Ladino with orchard

grass is rated very high. On poorly drained land Ladino with reed-canary grass looks very promising; one field this year has produced 10 tons per acre and there is a heavy growth on the ground to go into the winter. At this station Ladino is distinguished for its ability to live through drought periods as well as its adaptation to low land.

On Wood Ford Farm, Hartford County, Conn., J. J. Anderson rates Ladino very high for pasture and grass silage but feels that alfalfa yields more and can be more easily handled for hay where a satisfactory stand can be maintained. As a consequence, his upland fields are planted to alfalfa for hay; yet 5 percent of the mixture he seeds is Ladino clover and where the ground is too wet for alfalfa there is a perfect stand of Ladino. In the bottomland which is subject to overflow for a week or more at a time by the Farmington River, he is trying out four different mixtures with Ladino clover. Mr. Anderson expects, from his observations thus far, that Ladino and timothy for grass silage will be the answer to his problem on this bottomland.

On one Ladino field of 10 acres, Mr. Anderson put up 147,050 pounds of green material averaging 60 to 65 percent moisture from the first cutting. On another field of 5½ acres, seeded in the spring of 1939 with 3 pounds of Ladino clover alone, per acre, 13,850 pounds per acre were removed in the first cutting this year and 145 cow days of grazing per acre were obtained. On this farm corn acreage has been reduced 50 percent since the making of grass silage was started.

At Judd's Bridge Farm, in Litchfield County, Conn., the practice of using grass silage is strongly entrenched because it keeps the milk production at an even level from day to day and month to month. The herd does not vary more than 50 quarts per day within any one month, in the total production that runs as high as 2,000 quarts daily. George DeVoe finds that the cows



At the silo the load is dumped and the wagon is ready for reloading.

are kept in much healthier condition with the use of grass silage and that it is possible to get a high level of milk production with a much wider nutritive ratio in the grain. Formerly a grain ration of 16 to 18 percent protein was used, but now it averages from 12 to 14 percent. With the use of grass silage and this low protein feeding, including considerable home-grown timothy and clover hay of high quality fed throughout the summer, the cows maintain a high level of milk production throughout the lactation period.

Mr. DeVoe is very enthusiastic about Ladino clover. He has a mountainside field of waste land which has been cleared of brush, fertilized, and seeded at a cost of \$65 to \$70 per acre. The treatment included 2 tons of lime, 500 pounds of superphosphate, a 1941 spring seeding of oats, Ladino, wild white, alsike, and red clover and several grasses. He has obtained 150 cow days per acre of grazing from this pasture this year. However, he believes that Ladino clover with the one grass best adapted to the land and the forage use, is better than such "shotgun" mixtures. Like many other farmers, he has found that he can save much more roughage of high quality by making grass silage, because rainy weather and dew interfere with hay making. This farm lies along the Shepaug River and much of the land is very steep, but there has been no erosion problem since grass farming was adopted, except occasional bank damage when the river is at flood stage.

J. A. Cooper, of Sunset Farm, Worcester County, Mass., also has cut the percentage of protein in the grain mixture for his dairy cows—from 20 percent to 15 percent—by substituting grass and Ladino silage for corn silage.

Professor Parsons, of the Massachusetts State College, emphasizes the value of Ladino clover over the grasses. He points out that it is not wasted when growing conditions are unusually favorable and growth is several days ahead of the cattle. (When this happens to bluegrass, dairy cows will not eat enough of it to maintain a high level of production.) At this station Dr. W. G. Colby has under way an excellent experiment to compare the performance of several grasses mixed with Ladino clover. He is testing for grasses that maintain themselves adequately, produce well in the second and third cuttings and at the same time do not crowd out Ladino clover as Kentucky bluegrass has done in so many instances. Dr. Colby says that 3 to 5 years is about the average life of a good Ladino pasture in Massachusetts.

At the New Hampshire Experiment Station, Professor Ford S. Prince is working with productive



Feeding the ensilage-cutter, which has been set low to reduce lifting. Solid footing makes the work easier.

strains of timothy. Two of these in the preliminary stages appear very promising when seeded with Ladino clover because of their recovery after cutting for hay. In New England such second growth is called rowen. At this station excellent use is being made of a bush and bog disk harrow to prepare rough land for pasture seedings.

At the Turkey Hill Farm, Cornell University, Dr. Richard Bradfield is carrying on a remarkable demonstration in the reclamation of an abandoned field of Volusia soil. In the spring of 1940 the field was plowed and 400 pounds of limestone, 100 pounds of superphosphate and 1 pound of birdsfoot trefoil per acre was applied in 14-inch spaced rows by means of a cultipacker with a drilling attachment. This appears to be a very logical and low-cost first step in the establishment of a good pasture on poor land.

Ray E. Wing, county agent of Windham County, Conn., is an ardent believer in grass farming but has not given up corn and does not believe in pushing grass silage. He has about 4 acres of corn out of 60 acres of improved pasture and cropland. Like many other successful dairymen, he feeds a little hay all summer regardless of how good his pastures are, as he recognizes that the nutrients in good hay are cheaper and just as palatable as those in grass silage. He feels that the chief reasons for making grass silage are the occasional shortages of pasture, and weather conditions which interfere with the making of good hay. The possibilities of increasing livestock production with grass are illustrated by his experience in taking over the management of a neglected farm that at the time was producing only 9 loads of hay. Within a few years he has increased the yield to 50 or 60 loads of hay, and has increased the acreage and the productivity of the pastures on this farm. Obviously, this improvement has involved liberal use of fertilizers.

Another example of this kind comes from the 40-acre farm of William F. Bailey, Kent County, R. I. With a steam shovel and a bulldozer, 10 acres of stony waste land were cleared of trees and partially cleared of rocks in the spring of 1940. The field was fertilized and seeded to oats and Ladino in the same spring. The total cost of reclaiming the land was \$250 per acre. This year the field produced \$80 worth of grass per acre. As Mr. Bailey buys all of his hay, and as he stopped hay feeding when he turned his cattle on to this pasture, he was able to put a fairly exact value on the forage the pasture produced by checking the saving in his hay bill. At first he apologized for spending so much money per acre on land of such low productivity; but then, he wondered, where could a man invest \$250 and get a return of \$80 in 1 year?

Further proof of the importance of fertilizer on pastureland comes from the farm of Francis W. Peaslee, Merrimac County, N. H. On this farm of 200 acres there are 60 acres of land that might be plowed, but instead it is all in grass. Mr. Peaslee raises no corn and makes no silage; he depends entirely upon the hay he raises for roughage. Last year he sold 40 tons of hay from this farm and he intends to increase his production so as to sell 60 tons annually. He keeps about 50 to 60 head of cattle and milks about 25 cows regularly. To reduce animal disease and parasite problems he rotates his poultry with his dairy

cattle on the same pastures, using some of them for poultry 1 year and then grazing with cattle for 2 years. He noticed that where the poultry houses were situated and the droppings killed out all of the vegetation, Ladino clover was the first plant to volunteer on the bare spots. Now he makes a practice of topdressing his pastures and meadows with complete fertilizer in addition to manure and poultry droppings.

This New Hampshire farmer says that before Ladino clover came into use he "couldn't make a success of grass farming because he couldn't grow enough white Dutch clover." Even with such excellent pastures, Mr. Peaslee feeds hay all summer. When he was asked about making hay from Ladino clover he replied that his cows were fond of it in any form, and no matter how brown it was.

Judging from the findings of experiment stations and the experience of farmers, we have ample justification for believing that we can swing a long way toward grassland farming and at the same time meet the wartime demands for agricultural products. These objectives can be accomplished by making greater use of grass and legumes in crop rotations along with proper liming and fertilizing, and by establishing good pastures and meadows on abandoned lands that are adapted to grass, and on misused land now in cultivation but which erodes too readily to be used regularly for cultivated crops.

UPS AND DOWNS OF A WYOMING RANCH

BY A. E. McCLYMONDS¹

WALTER J. PETERSON is one Wyoming rancher to whom soil conservation is a very real thing—"a life-saver." He is more than glad to talk about it, anytime and any place. Four years ago the Peterson household was shrouded with the gloom that comes with successive years of failure. Debts had piled high; the family's hold on the ranch near Upton, in northeastern Wyoming, was nearly broken. The outlook was black indeed—but that was 4 years ago.

"We're back on our feet again," said Peterson happily, when I talked with him in the field during this year's wheat harvest. "It's all because of soil conservation . . . soil conservation and Dick Lewallen, your man at Torrington. It must be that, because I used to work harder to make a go of it than I have to

work now, and I don't think I am any better farmer now than I was then, except that I know about soil conservation."

The Petersons' story, with its happy ending after bitter disappointment, is one to renew the faith of Soil Conservation Service workers in the axiom that the greater reward is the joy of helping others.

Twenty-two years ago Mr. and Mrs. Peterson settled on part of what is their present ranch—in those halcyon days when the Golden West was the land of opportunity, with lots of free land. Their son, now twenty one, has spent his life there. Hundreds of persons came from the shops and offices in that period, seeking escape, but the Petersons were not of these—they are farm people. Many settlers were disillusioned . . . found that farming in Wyoming was not like farming in more humid climes . . . and departed. Those

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A contour-planted shelterbelt on the Peterson farm; in a few years it is expected to furnish considerable protection.

who remained bought some of their land. Today Peterson, one of those who remained, like other ranchers in that territory, owns some of the land he operates and rents some—a section of State school land, some federally owned land, and a few private tracts belonging to those who tried and then moved on. In all, he operates a little less than 5,100 acres, most of which is grazing land.

In the heyday of dryland farming the Peterson crops were good, and so was life. The land was new then, capable of holding more of the rainfall. Prices for both grain and livestock were advantageous to the farmer during that post-World War period. But it was too good to last. The rainy spell ended, and the Petersons encountered conditions for which their experience had not prepared them.

“We know now that we were not farming the right way,” Peterson explained, “and when the dry years came along in the late '20's the dryland farmers began to lose out. Those who depended wholly upon cash crops went first, but those of us who had some livestock were able to hang on. For years we borrowed money for seed, worked hard all spring and summer trying to raise crops, and then had to borrow money to buy feed for the livestock. There were years when we didn't raise enough feed for the chickens, and let me tell you, living didn't get any more pleasant. By 1937, I was about through.”

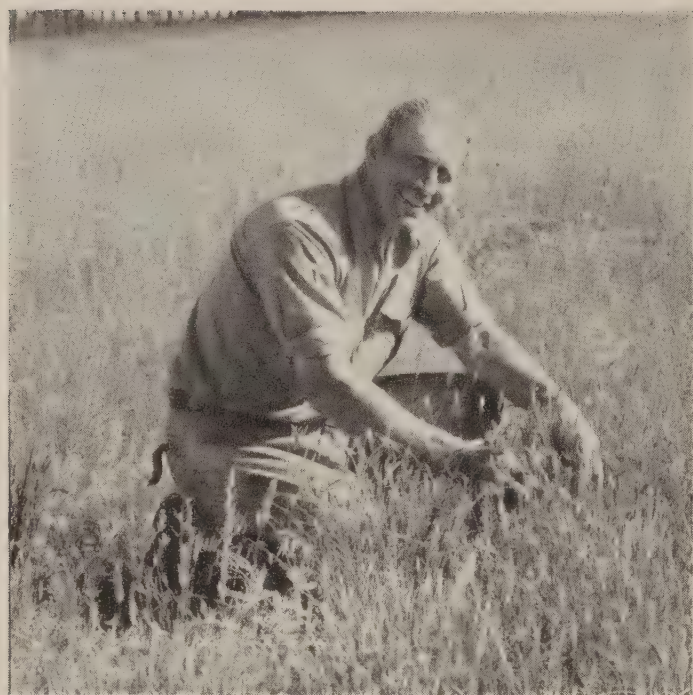
After a little while he continued: “When you see everything crumble, everything you've built up in a lifetime, your thoughts can get pretty dark. There isn't a whole lot of fight left in a man when that happens, you know, and such a man is pretty easily led by promises. We didn't think so then, but I can see now that we brought on a lot of our own troubles. Dick Lewallen hasn't said so, but the things he has taught me about soil conservation have proved quite clearly

that we should have had at least feed crops in some of those dry years.”

Lewallen came into Peterson's life when the county agent, planning his county's extension demonstration

The first year he farmed by contour Peterson raised corn which stood about 6 feet tall and had 10-inch ears. At the same time, corn on land he had not yet brought into contour cultivation grew only 2½ feet tall and the ears were nubbins. Here is Peterson comparing a stalk of corn grown on the contour with a sample from a straight-row field.





The first step in the revamping of the farm was the planting of four pounds of crested wheatgrass seed. The seed had been procured by the county agent and was planted in the fall of 1936. There was enough of it to cover one and three-fourths acres in a five-acre pasture near the house. This plot was the source of seed for other areas, and now Peterson has a good stand of wheatgrass on about 125 other acres. In the spring of 1941 Peterson pastured 60 ewes in this pasture for six weeks, and although every ewe had two or three lambs they were able to produce enough milk for them. Here Peterson is shown in the wheatgrass a month after the sheep were removed.

farm program with Soil Conservation Service workers, pointed out that if there was anything to the soil conservation idea the Peterson ranch was the place to show it . . . there was a man—Peterson—known to be progressive and a hard worker who had some real problems. However, it was not a case of greeting each other with open arms; Peterson was really blocked by circumstances and, he confesses now, was not particularly enthusiastic, in the beginning, about the soil conservation program. Lewallen, already busy with extension demonstration farms elsewhere in eastern Wyoming, and heading up the Goshen Hole soil conservation demonstration project, did not care to hold out false hope in case Peterson needed more than assistance on the land. Nor did he feel that he could devote a lot of time on the place unless he was reasonably sure of effective cooperation. There was a little sparring, a visit to the ranch to talk things over; before long Peterson and Lewallen were “clicking” in a fast friendship.

“Contouring looked funny to me, and I must have been a little hard to convince at times,” said Peterson. “But after the way Dick worked, I just couldn’t let him down. Now I’m glad I didn’t. From the time

we started our first contour farming, we have been getting back on our feet. Let me tell you a funny one. The first year, 1937, was dry, but my corn on that contoured field grew 6 feet tall and the ears were 10 inches long. Other corn around here that year was about right for using a header, if it could have been harvested that way—only 2½ feet tall and mere nubbins for ears. Borrowing money for stock feed was about over for me. I showed my corn in town, and the people just wouldn’t believe that I had raised it that year, that I had a whole field of such corn. Only a few people bothered to come out to see for themselves.”

Contouring of this first field was, of course, only the start at reorganizing the whole ranch, a process that still is going on. Peterson was too much a cash-grain farmer; he needed a broader income base. He would have to produce more feed for the larger numbers of livestock he needed to balance his operations.

Plans for the cultivated lands aimed toward producing more crops on less land and consolidating the cultivated areas for economy in operation. Peterson was farming 500 acres, of which 338 acres were in wheat, in 54 badly scattered fields. Today he is farming only 300 acres in less than half that many fields, and he plants only 69 acres to wheat. Only 43 acres of the cultivated land have not been affected by the reorganization, and as soon as a couple of gullies are obliterated the rearrangement will be completed. Then all cropland will be close to headquarters and in two units, one on each side of the highway. All will be contour farmed—strip cropped on the contour. Peterson has remarked on how the rearrangement already has cut down travel and hauling.

Work to improve the grazing land to support the livestock Peterson needs has gone ahead rapidly. It includes crested wheatgrass seeding on lands taken out of cultivation, seeding on depleted range lands, building stock water structures, water spreading, deferred and rotation grazing on native ranges.

Grass seeding actually was the first step toward revamping this ranch—when the county agent secured some crested wheatgrass seed from the Mandan, N. Dak., nursery of the United States Department of Agriculture in the fall of 1936. There was enough to make a seed plot on 1¾ acres in a small pasture between the house and the highway. This small plot already has furnished seed for 108 more acres that have been put in crested wheatgrass.

One thing about the reorganization that pleases Peterson is the fact that he is farming less land and raising more crops.

"This year has been like old times, with rains just right and all that," he remarked, "but I raised more crops this year on 300 acres than I ever raised on the 500 acres I used to cultivate. Remember, I farmed during those good years before the dry times and when the land was newer. It's hard to believe, but it's true; and I am storing up good livestock feed reserves for the first time."

The 43 acres of Peterson's cropland which are not yet farmed on the contour—part of his best land—give opportunity for some interesting comparisons even in this year of "just right" rainfall. Peterson reports some impressive yields: the 56 acres of contoured wheat yielded 29 bushels an acre, compared with 23 bushels an acre on the 13-acre field not contoured; the 39 contoured acres of oats produced 26 bushels per acre, compared with 18 bushels an acre on the 15 uncontroled acres; and the 24 contoured acres of barley yielded 24½ bushels an acre while the 15 uncontroled acres produced only 18 bushels per acre. All the corn and rye was on the contour, the former producing 35 bushels an acre and the latter 20 bushels an acre. Good crops this year on uncontroled fields, better ones where farmed on the contour.

"Those yields startled me," Peterson remarked, "because the grain on the land that wasn't contoured looked every bit as good as the grain on the contoured fields. But there are the figures: I was anxious to know, and was careful to harvest each field separately and keep an accurate record of what I got from each. I'm not guessing when I say that contour farming paid

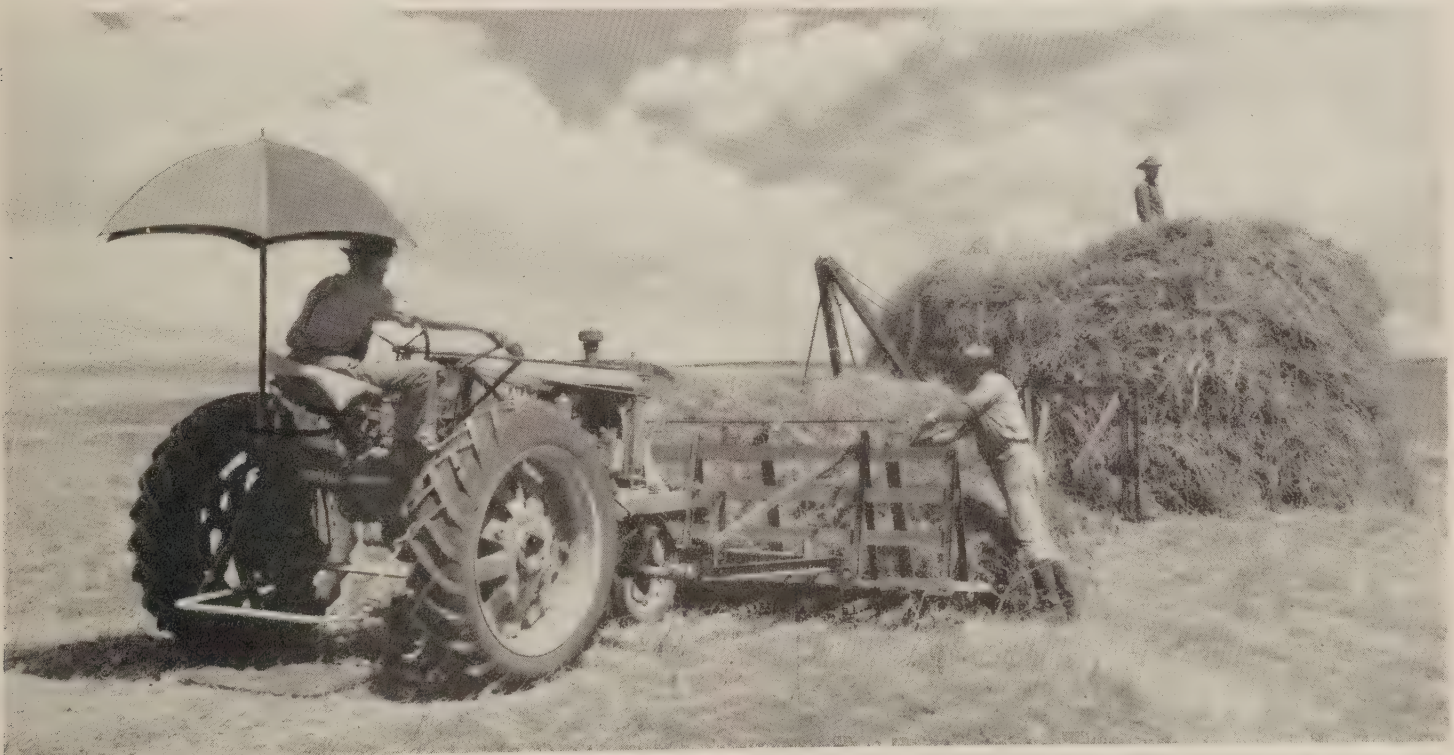


A good-sized garden is part of the scheme of things at the Walter J. Peterson farm. Here Mrs. Peterson hoes in the garden.

me several dollars an acre even in a year like this."

Add these yield figures for 1941: Rye hay taken from a 21-acre contoured field totaled 31 tons; the oats straw from the fields mentioned above amounted to 54 tons; 6 tons of hay came from 7 acres of sweetclover; 23 acres of crested wheatgrass produced 945 bushels of seed; and 46 acres of crested wheatgrass yielded 40 tons of hay.

"But it wasn't years like this that broke so many and put me in the position of almost losing this place," Peterson reminded me. "It was last year that really convinced me that contour farming is about the best crop insurance you can get. Last year was as bad as any I have ever seen. The only rain we had came the



Peterson, his son, and a neighbor stacking rye hay which was grown on the contour on this upland farm.

last of May, but my corn grew over 6 feet tall and had good-sized ears. The barley amounted to 300 bushels; oats the same, and the wheat 500 bushels. I produced 120 tons of feed for the livestock in 1940, a year that was as bad as any—I believe it was about the worst year—and still I raised enough feed. That proved to me that there will be mighty few years, if any, when we can't raise a crop; and I'll have enough feed reserves to carry on if harder years come. We'll not have to borrow to get stock feed or to dump stock on the market."

Progress on the grasslands has been as impressive, although less spectacular, as on the cultivated areas.

"This crested wheatgrass is one of the most important things on the ranch," Peterson observed. "It starts growing and can be grazed considerably before the native grasses are ready, and it greens up after every shower. It really can take it, too. Just this spring, for instance, 60 of my ewes had twin or triplet lambs. I moved them to that crested wheatgrass plot beside the house and kept them there for 6 weeks. Although every one of those ewes had two or three lambs, they were able to produce enough milk. Not one of the lambs was lost, and they're large for twins and triplets."

Thirty-seven acres of the crested wheatgrass is divided into five pastures, each with a shed, for a lambing set-up. Lambing is done in the first pasture, and each day the lambs are moved progressively from one pasture to another. On the sixth day they go out into the big pasture, or range.

"We can keep track of the lambs better," Peterson explained. "We know, for instance, that those in the third pasture are 3 days old, and having them in lots where there are shelters cuts down losses. Last year this plan was worth a good deal. There was a bad storm during lambing. Some of the neighbors' losses ran as high as 150, but we didn't lose one because of storm."

Peterson likes to tell about Lewallen locating the stock water dam in the rented school land section, about a half-mile east of the house. Peterson knew just about where he wanted the dam, but could see no way out but to construct a spillway.

"Dick got out his field level and started looking around, and it was only a few minutes later that he called over to me: 'Better put it a little farther upstream, Walt; you've got a dandy natural spillway.' I couldn't see it, so Dick had me look through the level. Sure enough, right through the best grassed part of the bottom land was a broad gentle channel."

Peterson built the dam, a simple and inexpensive job. The spillway takes the overflow water from the

head of the pond and spreads it out over the pasture below the dam. The system has operated several times this year and the grass is something to behold.

Tangible evidence of the improvement of Peterson's range land has shown up gradually. In 1937 he had 300 sheep, 6 head of cattle, 4 horses and 40 hens. The range was in poor condition and hardly adequate for even that amount of stock, and he had not been able to raise enough feed for them. His lamb crop was only 70 percent that year.

Within the last year he has added to his livestock—with the help of the Farm Security Administration and in line with Lewallen's recommendations to get a better balanced unit—and his grasslands had improved so that he could care for more animals. He now has 915 ewes, 300 lambs, 18 cattle, 6 horses, about 300 laying hens. He had a 98-percent lamb crop last spring.

How are the animals faring? Well, Peterson has some figures on this too, although only for the last 2 years.

"My lambs were 10 pounds heavier this year than last, which means that on the basis of present prices they were worth \$1 more per head," he pointed out. "Then, the 1940 wool clip was 7½ pounds per sheep, compared with 8¼ pounds per sheep that I got this year.

"So, here we are," the rancher concluded, "with wheat filling about every building on the place, even the turkey house; more livestock than ever and plenty of feed for them. We have a good garden, lots of chickens, just about everything a man could want on a farm. We are paying off those debts that had piled up so high, and paying them off fast, and we won't have to borrow money to carry stock over bad years any more. Now we're looking ahead to improving our home, and our son has come to think that farming is a good thing after all."

THE CCC MARCHES ON

(Continued from p. 214)

strengthened their morale—the thousands of ex-enrollees now in the armed forces will be more physically able and more determined to defend the country they have helped make richer and stronger. Thousands of enrollees learned skills in the CCC. Many of them are now in defense industries—some using the resources they helped to conserve to make matériel for its defense.

Another year has seen the value of the CCC augmented, and the past accomplishments of the CCC multiplied in importance. The investment in youth has become a richly productive investment in the future of the country.

WHAT OF THE WESTERN FRONT?

BY FRANK KIMBALL ¹

THE SEVENTEEN western States occupy a major position in the food for freedom battle front. They have the land, water, and climate to assure maximum yields of agricultural and livestock products of select qualities. Since our entry into the war, the demands for increased food production have emphasized to a greater extent than ever before the importance of the irrigated lands within these States. As a result of this all-important incentive it is expected that farming and ranching operations in these areas will be geared to meet their share of production requirements.

Obviously, some redesigning of operations and practices will be necessary on many farms and ranches in order that the most economical and efficient methods may be adopted to obtain the desired results. Required increases in amounts of sugar, poultry, dairy, and garden products, however, will necessitate more intensive operations of the kinds most suitable to irrigated farming areas. In this work every ounce of productive labor is important. None should be wasted and, without doubt, successful campaigns against soil and water losses will constitute one of the most effective steps in achieving the production objectives.

Water is the limiting factor for irrigated agriculture, and water supplies are dependent upon the uses made of watershed lands. Adequate protection of water supplies must come through sustained management of watershed lands in the interest of land and water resources, and through measures designed to check depletion of the vegetative cover, retard run-off, and prevent soil erosion. For these reasons sound agricultural programs in western areas are directly concerned with problems of beneficial use of water.

Western water problems are numerous and complex. Many of the most serious problems are the result of haphazard and undesigned growth of irrigated agriculture and disregard of its economic influence on other watershed uses and problems. Early efforts of individual farmers, as well as groups of farmers, were confined mainly to diverting small streams over adjacent valley lands for crop use by simple and inexpensive methods. When the success of this type of agriculture became known, land values increased, larger and more difficult projects were planned and constructed, irrigation districts came into existence, and

legislation was enacted to govern the appropriation and use of water.

With the gradual adjudication of water rights to individuals and companies on the basis of beneficial use, the importance of the vast network of diversions, storage reservoirs, and distribution systems became fully established. These water rights have been vigorously protected, even though in many instances the total quantities of water for which filings and appropriations were claimed greatly exceeded available supplies in some streams. Many diversions and many more miles of canals were constructed than were necessary to serve the total acreage irrigated. These factors contributed to excessive transmission and other losses of water to the detriment of all appropriators from such streams. In a few areas, large Federal projects have now eliminated some of these unsatisfactory conditions, but the bulk of the improvement still to be done is in areas where large projects are not feasible.

Wasteful methods of conducting water or applying it to the land were commonly practiced by early irrigators because such methods could be employed without causing material injury to other land users. With the further development and extension of irrigated areas attention was focused more sharply upon the role of water, and it soon became established that no appropriator had a valid right to use wasteful methods in exercising his water right. While much improvement in abusive uses and methods has been accomplished, their correction is still the most important problem to be solved in many of these western areas. A tremendous amount of rehabilitation and improvement work remains to be done on diversions, storage reservoirs, distribution systems, and to irrigated lands, to bring about an equitable apportionment of water among the users of the various streams, and to meet the requirements for economic and beneficial use as based on the rights and needs of all the users. In many areas this improvement work will require organized group action, and in such areas it is of utmost importance to the individual water users.

The water problems we are facing in these irrigated areas are numerous; they vary widely between different irrigation districts as well as between individual farms in these districts. Some of the problems common to large numbers of farms are centered around the following: poor distribution systems; improper land preparation; wasteful irrigation practices; needs for

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fertilizing and for soil-building rotations; need for weed control.

Solution of these problems requires adoption of farming methods and soil-building practices consistent with the kinds of crops grown and the variability of the soils in each field. The farmer must examine and study his soils to learn their physical characteristics, capabilities, and requirements for plant food. In the application of water to crops the arrangement of the farm and field distribution systems, including borders, furrows, corrugations, and other related works, should be made such that an even distribution of water can be supplied to the root zone of the plants with the least waste of water, soil, and plant food. A knowledge of the development of the root systems of the various kinds of plants is necessary in order to apply the right amount of water to secure the desired moisture penetration into the root zones. Visual tests made to estimate the soil moisture content in various parts of the fields will become easier as irrigating experience is gained, and will help the farmer to become more adept in determining when additional water should be applied.

The use of too much water may drown the crops, cause waterlogging, leach out valuable plant food, and in many instances cause soil erosion. The times and amounts of water deliveries at the farmer's headgate

will have a major influence on his willingness and ability to make the best use of it. This is one of his problems that can only be solved through organized group action with other water users who are dependent on the same source of supply. In many irrigation districts similar problems have been successfully met through practicing rotation deliveries of water, but even this method will require some modification to meet special crop needs. In any given area the success of irrigated farming depends largely upon the continued cooperative action among all water users in the interest of good soil and water management.

In some of the irrigated sections weather conditions between irrigation seasons are severe and allow the farmers very little time to make needed repairs and improvements. Now that it is necessary to restrict the production of certain new implements and machines, more alertness will be required on the part of all farmers to keep their operating units in good working condition.

Nothing short of all-out intensified efforts on the part of all land users should be the contribution of each to help conserve the national resources so vitally needed at this time for the production of food. The continued protection of all soil and water resources will largely determine the future welfare and security of the Nation.

FARM CONSERVATION PLANNING FOR WAR NEEDS

(Continued from back cover)

necessary in the "food for freedom" program. This situation has raised several questions relative to conservation. For example, is increased production of agricultural products inconsistent with conservation? Since agriculture must give first consideration to increased production for war needs, will we have to forget about conservation for the time being? Since winning the war is of first importance, are we justified in countenancing destruction of soil resources?

The 1942 production goal.—Before answering these questions, let us look at several aspects of the present situation. There is a need for increased production of many agricultural commodities for increased domestic use and the support of our own armed forces, for lease-lend aid to our allies, and for the building up of reserve "stock piles" to meet future emergencies.

Production goals have been established for 1942. These goals call for an increase in livestock and livestock products of from 5 to 15 percent over 1941 production—with a 14-percent increase in hogs, 7-percent in milk, and 8-percent in slaughter of cattle

and calves. Increases of 10 percent are needed in the several classes of poultry and 13 percent in eggs. A 54-percent increase is needed in soybeans and a 155-percent increase in peanuts. Commercial truck crops should be increased about 10 percent. Dry field peas should be increased 73 percent and dry beans 13 percent. Corn and cotton should each be increased 8 percent. Acreage restrictions on sugar beets, sugarcane, and rice are removed. Supplies of wheat are still excessive, however, and the acreage of this crop should be reduced 12 percent, this being the only farm crop for which the 1942 goal is less than the 1941 production. These are the goals for 1942. It is possible that still larger goals may be established for 1943.

It is probable that the war will last longer than many of us like to contemplate. Even after the close of hostilities, we will need to produce large supplies of agricultural products in this country until the devastated countries can get their land back into production. Therefore, this is not a 1-year program. We should probably plan on increased production for at least 5 years. After the war and the post-war adjustment period, we will have need for production for domestic and export demands. Even though we must run in high gear for a few years, we must keep

our agricultural machine in proper condition for continued use in more normal periods.

Increased production is not inconsistent with conservation.—On the other hand, much more consideration of land-use capabilities and maintenance of the productive capacity of the land is a necessary component part of the efforts to win the war and the ensuing peace. Rather than throw conservation “out the window” along with “business as usual,” it should be given greater attention at this time in order that we may meet the present production needs and still keep our plant in proper order to supply the future needs of the Nation.

How then can this increased production be achieved within the framework of conservation? The present situation calls for more intensive use of good tillable lands. The admissible intensity of use is dependent on the use capabilities of the land. Therefore, widespread attention, in the allocation of production goals to States or counties or to individual farms, should be given to land-use capabilities. The same is true in determining the part of a particular farm upon which the increased allotment should be produced.

Good lands can be used intensively.—In increasing the production of clean-tilled crops, first attention should be given to maximum intensity of use of land in capability class I. Land in class I consists of level or gently sloping areas, generally fairly high in fertility, which can be cultivated safely and permanently without special practices for control of erosion. Even though this class of land were kept in continuous clean-tilled crops, it would not be destroyed by erosion. It is true that continuous clean tillage probably would reduce the organic matter content and change the soil structure and thus eventually reduce yields; but in an emergency it probably is advisable to capitalize on some of the stored-up fertility of these lands. Since the soil is not lost through erosion, the organic matter can be restored at a later date. It is known, however, that on some of the soils in this class the growing of a legume sod crop once in 4 years will make possible larger total production for the remaining 3 years than would be produced in 4 years without the legume sod crop. On such soils, the growing of continuous clean-tilled crops even for a 5-year period would be questionable.

Sloping lands must be safeguarded.—On more rolling cropland falling in capability classes II and III, some farmers can increase acreages of clean-tilled crops, with greater total production, provided increased use is made of conservation measures such as contour tillage, strip cropping, and terracing. Such practices make possible the use of a higher proportion of intertilled

crops in the rotation than otherwise would be justified. Some farmers who are now conserving their soil resources by the use of a long rotation with a high proportion of grasses are in a position to increase the acreage of intertilled crops by intensifying the use of other control measures.

On many farms in this class, however, production cannot be maximized by increasing the acreage of intertilled crops. It is on these farms that the use of conservation practices offers most in the way of increasing production. An increase in intertilled crops at the expense of legume sod crops might actually reduce production over a 5-year period.

Increases in yields as a result of water-conservation practices are larger than is commonly recognized. For example, records kept in the Southern Great Plains show that contouring and level terracing increased yields of beans from 165 pounds per acre to 243 pounds, or 47 percent. These practices increased the yield of wheat from 11.5 bushels to 15.1 bushels per acre, or an increase of 31 percent. Contouring alone increased the yield of grain sorghums from 461 pounds per acre to 589 pounds, or 27 percent; while terracing in addition to contouring increased this yield to 723 pounds per acre or 57 percent more than was obtained by cultivating up and down the slope.

While increases in yields as a result of water-conservation practices are most spectacular in areas where rainfall is very limited, they are by no means confined to these areas. For example, contour listing of corn in Southwest Iowa increased corn yields 46 percent during the 3-year period, 1933 to 1935. An even greater percentage of increase occurred during the very hot and dry season of 1934. While lesser increases due to contour tillage might be expected on flat-planted corn than on listed corn, and while lack of moisture may limit the yield of corn in a lesser proportion of years in the eastern Corn Belt than in the western part, nevertheless many observations seem to justify an estimate of 20 percent increase in corn yield per acre due to contour cultivation in a large proportion of the Corn Belt. Thus, in those areas, the use of contour cultivation on the present corn acreage would increase production as much as would a 20-percent increase in acreage without contouring. Furthermore, this increased production would be obtained with but little increase in farm labor and machinery which would be required with increased acreage.

Use legumes for feed and soil fertility.—One of the best methods of increasing total production of crops for livestock feeding, even for a short-time period, is to increase the acreage of legume sod crops. Such crops

not only increase yield of row crops that follow the turning under of the legumes, but they also provide livestock feed. Greater amounts of dairy products and beef are needed. Beef and dairy cattle require roughage as well as grain. In some cases, larger amounts of digestible nutrients per acre may be produced in legume hay than in grain. For example, one and one-half tons of clover hay contain 1,500 pounds of digestible nutrients while 30 bushels of corn contain 1,400 pounds. The kind of hay produced is important if one is considering maximum production of livestock feeds. The legumes contain more digestible nutrients than do the grasses. For example, a ton of alfalfa hay contains 1,032 pounds of digestible nutrients, a ton of clover hay 1,019 pounds, while a ton of timothy hay contains only 970 pounds. On many soils additional lime and fertilizer are needed for the production of legumes. Increased use of lime and fertilizer is needed especially during this period of emergency in order that the quality and amount of hay may be increased and also that the yield of grain crops may be maximized.

Pasture land in accelerated production.—Like crop lands, pasture lands also should be utilized to maximum efficiency. Where pasture is now located on good tillable land, with a productive capacity that can be maintained in cultivation, it may be that in some instances it will be desirable to put this land in rotation crops.

Certainly nothing can be gained by breaking up rough pasture land that is not suited for cultivation. To do so would result not only in inefficient and high-cost production during the next few years, but in erosion that would cause irreparable damage and thereby reduce the possibilities of efficient future returns from such lands. The destruction of lands necessary for the permanent well-being of the Nation must be avoided. "What doth it profit a nation if it wins the war but loses its basis of future prosperity."

Since, in the food for freedom program we need increased production of livestock and livestock products, and since pasture is one of the best and cheapest sources of livestock feed, increased attention should be given, especially in this period, to increasing the carrying capacity of pasture through proper management, including liming, fertilization, mowing, and proper grazing. The productive capacity of many of our permanent pastures can be increased from one-half to threefold through such management. Increased use of supplementary pastures for grazing during the months when the growth of permanent pasture is slow will increase livestock production by providing a more constant month-to-month supply of grazing.

The farm production program must be balanced.—Now, while production goals are being established and farmers are being asked to increase production of certain commodities, we should give much greater attention to proper balancing of the production program. Not all farms and farmers are equally suited to a flat percentage increase in the production of the several commodities for which there is increased need. To some extent this has been taken into account in establishing production goals and in breaking down the national goals into State and county goals, but it should receive additional attention in distributing township or community goals to individual farms. Probably little can be gained by getting the dairyman who has but little knowledge or experience in hog production to produce more pork, or the hog producer to produce more dairy products. If, in a certain community, a 10-percent increase is needed in both dairy products and pork, probably the dairyman who has the farm, equipment, and knowledge suited to dairy production should increase dairy production 20 percent and not increase pork production at all; while the hog grower would increase hog production by a like amount and dairying not at all.

As I pointed out in a previous article,² the farm program should be planned in accordance with the needs and adaptabilities of the farmer as well as the needs and adaptabilities of the land. In this case, we should consider the individual farmer's share of the needs of the Nation for increased production as a part of the needs of the farmer.

In planning individual farm programs, the farmer and those technicians who are planning with him, should consider not only what products can be increased logically on the particular farm, but also the means of obtaining such increases. For example, an increase in numbers of dairy cattle is not warranted if the feed for these cattle is not adequate. Nor does increased production of dairy products necessarily call for an increase in numbers of dairy cattle. If pasture is inadequate for the present dairy herd, or if hay is scanty in amount or poor in quality, first attention should be given to eliminating these bottlenecks. In many instances more beef may be produced in overgrazed areas if the number of cows is reduced. More corn can be produced even during the emergency period if fewer acres are planted, on the contour and following sod legumes, than if corn acreage is increased promiscuously without the more important contour and legume considerations.

(Continued on p. 232)

² SOIL CONSERVATION, January 1942. "Consider the Farmer as Well as the Farm."

MICHIGAN DISTRICT GROWS MILLIONS OF TREES

TWO years ago on May 1, 1939, all that the South Muskegon Soil Conservation District had was a board of directors, two Soil Conservation Service farm planners just reporting for duty, and 50,000 acres of sandy land that needed attention—needed it badly and at once.

Twenty days passed—and the district had in actual operation a million-tree nursery. Then the spring of 1941 came around, and South Muskegon could boast of 800,000 “2-0” trees from that original nursery lay-out.

That this Michigan district was able to lay out nursery beds and plant a million seeds in less than 3 weeks, from scratch, is explained by the simple fact that the farmers were willing to roll up their sleeves and go to work. The district chairman, Olaf Hostad, had some land he did not need, so the farmers turned it into a nursery. They made the beds, planted the seed, built shade panels, installed irrigating equipment, weeded the sprouting seedlings.

Last fall 85,000 red pine seedlings were lifted from the original seeding and planted in open fields. The actual cash outlay to produce this number of seedlings, plus the 800,000 lifted in 1941, was approximately 50 cents per thousand. Costs were kept at this remarkably low figure through use of donated labor. Persons incarcerated in the local jail for minor offenses were

made available by the sheriff. The Welfare Commission arranged for labor from relief rolls. The National Youth Administration contributed by approving a nursery activities project. Muskegon high-school students, anxious to learn, contributed their time, as did many farmers. Some local labor was hired at 25 cents per hour.

In the spring of 1940 the South Muskegon directors started all over again—they seeded enough beds for another 2 million trees. A year later they duplicated this. They will take off pine seedlings at the rate of 2 million a year, for use on the 50,000 acres of sandy land that once grew the finest of forests and now must be coaxed back under the same kind of protective cover. This district has been busy with transplanting, too. In 1940 the men lined out 780,000 seedlings; increased this to 1,250,000 in 1941, speeding up the job by adapting a celery planter. This machine cut transplanting costs around 70 percent.

The 12,000 acres of blown sand, plus 40,000 acres not yet out of control but in need of stabilizing, will require at least 50 million trees for complete reforestation. The South Muskegon people know that the 5 million already produced or started will not finish the job, but with their goal in sight they are going forward, steadily and enthusiastically, with their plans.—F. E. Charles.

FIELDS PLOWED IN BEDS FOR DRAINAGE

R. W. Rogers, engineer of the Bolivar, Tenn., CCC camp, has reported unusually good results from the use of “bedding” and field drains in a field of bottomland on the John Wilson farm lying back from Hatchie River on Muddy Creek.

Twelve acres of this field were cleared of brush and scrub timber in 1934 and 48 additional acres in 1936. Each year thereafter, through 1939, the owner tried to grow corn, but each year he failed almost completely because of poor drainage; some of the corn was so poor that it was not worth gathering, and other portions of the field yielded very low amounts. In July 1939 when the soil was mapped—it is of the Chewalla and Alamo series—the fields were wet and in some spots miry from standing water. The natural fall of this land is about 0.2 to 0.3 foot per 100 feet.

The plan devised later for Wilson's farm included shallow field drains and “bedding.” The beds were about 66 feet wide. They were formed by plowing to the center, leaving a dead furrow between beds. The dead furrows were cleared by making two rounds with a V-drag, thus forming a shallow lateral drain to feed into the main drain. In 1940 a corn crop considered good for the locality was grown on these bedded fields; two small measured plots yielded 39 bushels and 44 bushels per acre respectively.

Mr. Wilson is greatly pleased with the results. He estimates that his corn yield this year will be about the same as last year's crop. He realizes also that the placing of these bottomlands in cultivation will permit a less intensive use of adjoining hill lands.

WAR AND SOIL CONSERVATION

By ANGUS McDONALD¹

AN ARMY marches on its stomach; its feet won't move fast if its stomach is empty. This means that a war can't be won without plenty of food. It also means that the soil must produce more. And sometimes producing more food isn't good for the soil.

For example, during the first World War we plowed up a lot of new land that shouldn't have been put in crops at all. Eleven million acres of grassland in Nebraska, Kansas, Colorado, Oklahoma, and Texas were plowed up for the first time. The annual acreage in wheat increased over all the country from 47 million acres (average annual production, 1909-13) to 74 millions in 1919 and the total acreage in crops increased by about 40 million acres.

One result of all this plowing up was the Dust Bowl. Thousands of farmers saw their crops smothered with dust and their best soil blown away. In 1934 there were such terrific dust storms that you couldn't see 25 feet. And when the dust settled a little, as far as you could see was an expanse of sand and soil piled in drifts. The plains were dotted with shacks and deserted houses and sometimes you would see skeletons of animals that had died from thirst and starvation.

All this land had been plowed up during or shortly after the World War. It had been put in \$2 wheat. After the dust storms some of the blown-out farmers would have been lucky to get \$2 an acre. The long dry spell had come. When the soil was first cultivated it was rich in rotted vegetation. But by 1934 it had changed. It had a fine texture by then and the organic matter that had pasted it together was gone. There were millions of acres like this.

Some of it was so eroded that it never would be any good again. Some of it would raise a crop when another wet period came. With a wet period would come another wave of farmers who would plow up the dry land and cultivate it until the inevitable dry period came again. Then they would leave. This has been the history of the dry country.

In 1934 they left by the thousands from sections where only hundreds had left before. I've seen them heading west with their dilapidated trucks and cars packed to the gills with their household stuff. In 1934 it was much worse because much more of the dry land had been plowed than ever before, the soil was in a more blowy condition and the dry period was longer.

High prices, wet years, the Government campaign for wheat, for food to the Allies, caused the Dust Bowl settlers to ruin their land.

Another result of wartime plowing was water erosion. In the South and in other parts of the country the farmers put their steep land in row crops. Some farmers, even in the South, had only grown a few acres of cotton. They had kept their most sloping land out of row crops.

The war changed all this. You cannot argue against 40¢ cotton. Many of these farmers made \$100 an acre on cotton land. They made big money in 1919, but in 1920 the price went to 6 cents and they had to borrow money at the bank. Many of them finally lost their farms.

They had been pulled into the cash-crop rut by high prices. Then one or two failures and they found themselves in debt. Once in debt they had to keep on raising cash crops such as wheat, cotton, or tobacco, and the land got poorer than ever. In many places it became so gullied that it was finally abandoned.

In some ways the United States is in a similar position in this war. We are feeding about one-fourth of the population of England. The Secretary of Agriculture has asked the American farmers to produce in 1942 the greatest crop in history. If these plans work out, milk production will be increased from 117 billion pounds in 1941 to 125 billion in 1942. Pork production will be increased from 17.8 billion pounds to 18.7 billion pounds. Beef production will be increased 15 percent over 1941, and chickens 13 percent.

We will send to the British in 1942: About 4½ billion pounds of milk; one-half billion dozen eggs; 18 million pounds of poultry; 1¼ billion pounds of pork and lard; 1¼ million tons of fruit, and 2½ million cases of canned vegetables. All of these products will feed about 10 million people and amount to from 6 to 8 percent of our own production.

Plans have also been made to increase the amount of food going to our own people. Fifty percent of the draftees were suffering from some physical or mental defect and many of these defects were caused by an inadequate diet. War and the threat of war will, as 25 years ago, place a greater burden on the soil.

There are two important differences though. One is that the people and the Government have become soil-erosion conscious. We have learned how to con-

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serve the soil and at the same time maintain and even increase production.

The country became aroused over the menace of erosion when Dust Bowl soil was lifted high into the air and blown clear across the country and deposited in the Atlantic Ocean. The Soil Conservation Service was established and for the first time the soil conservation effort became national. Before that time a beginning had been made. A small amount of money was appropriated by Congress in 1930 and 10 soil and water conservation stations were started.

After 1935 erosion was attacked on a broader scale. Many thousands of experiments were carried out in places most afflicted by erosion. Tests were made of soil and water losses under different crops and conditions. Terraces were built, check dams were developed, new crops were tried out that would prevent erosion and still give the farmer a living. Rotations, strip cropping, different methods of cultivation were tested. New machinery was invented both for the erosion laboratories and for the field. Instruments were designed, invented, and developed that would measure how water acted and how soil acted in water. Demonstration farms were started in every State and the cooperation of State experiment stations was utilized.

Attempts were also made to get the farmers to apply soil-conserving crops and methods. The knowledge and experience of former years was utilized.

Before this time erosion-control efforts had been largely haphazard. Individuals had been trying to stop erosion for over a hundred years but they had not been successful in getting farmers to apply their methods. And sometimes their methods had been wrong. Most of their terraces were built with too much fall and frequently more erosion was caused by a terrace than was prevented. This knowledge about terraces was used as a check against the new experiments.

The conservation movement got under way slowly. It was hard to change us from a Nation of soil wasters to soil builders. But more and more farmers became soil conservationists. They applied the knowledge gained by research; they profited from the help the Government gave them in advice, materials, and money.

The men at the State experiment stations—many had been interested in erosion for years—cooperated.

Often they took prominent places in the national organization. Because of their knowledge of soil and people their help was invaluable.

Year by year the number of soil conserving farmers increased. Year by year the methods worked better, more acres were put in soil building crops.

Soon groups of farmers united into districts, and States passed soil-conservation laws that gave these districts legal rights as well as help from the State governments. The area of land in soil conservation districts grew by leaps and bounds. Hundreds of thousands of farmers became converted to the soil-conservation gospel and signed 5-year agreements. Farms under these agreements were planned, land was classified as to its erodibility, rotation systems were worked out, and terraces, dams, and other structures were built by the farmers with the help of the Government.

The growth of the district idea was an example of how the American people could in a democratic way organize to prevent erosion. This, in a sense, was an answer to the dictators who said that democracy wouldn't work. By the end of 1941 there were 420,000,000 acres in soil-conservation districts. America became almost overnight a Nation of soil builders instead of a Nation of soil destroyers. This is one difference between 1917 and 1941. There will be no such criminal waste of the soil in this war crisis as there was before.

There is another important difference. This time no new acres that should be in grass and trees will be plowed up if the Department of Agriculture can help it. Although more milk, eggs, fruit, vegetables, poultry, pork, and beef are needed for Britain and for our own people, the increase in acreage of these products is more than offset by acreage reductions for wheat and cotton. We have too much of these products. There is enough wheat to last almost 2 years if we don't grow a blade in 1942. On August 1, we had a cotton carry-over of 12,200,000 bales. The war blitized the cotton exports.

Now the old gullies are filling up and not so many new ones are being started. The Government is no longer clamoring for wheat and cotton, for the farmers to plow up pasture and meadow. There is plenty of erosion, yes, but not so much as there was. The water has been slowed a little. War has come again, but new acres probably won't be plowed up this time.

THIS STOCKMAN BELIEVES IN SOIL CONSERVATION DISTRICTS

The stockman is William Lambert, of Piniele, Montana. He is the author of the address, reproduced in the following pages, which was delivered at educational meetings held to discuss formation of the Box Elder Soil Conservation District in Montana. George S. Severson, County Agent, Fallon and Carter Counties, Montana, sends us this statement about his "good friend" Bill Lambert:

"Mr. Lambert is a bona fide stockman, lives down in the south end of Carter County, near Piniele. He owns several sections of grazing land and runs quite a few head of cattle. At present he does not have very many stock as he sold down last fall but he tells me that he will buy back as soon as the prices seem right to him. He has not been to college—in fact, I do not think he graduated from Grade School. He is a member of AAA Committee in Carter County, and does a very good job in that position as he takes an interest in the work and does a lot of reading.

"Bill has a very likeable personality and an excellent understanding of the stock business, as he has been running cattle for the last 20 or 25 years. He has a nice set-up at his ranch. Bill's ranch formerly was not watered very well, but in the last 10 or 15 years—even before the AAA program—he started building stock water reservoirs. At the present time he has 13 reservoirs on his place, some of them as much as 10 or 15 years old. Most of these are large stock water reservoirs and hold water for 2 years or more.

"He is doing very little farming—just plans on raising enough for feed for his stock.

"I can assure you that Bill is a very good friend of mine and that I value his friendship very much."

THE purpose of this meeting today is to decide if we want to organize a Soil Conservation District in the Box Elder drainage area. This would include all of the Box Elder and tributaries in Carter County. All persons owning, leasing, or controlling land in this area would be included. If others outside the district wish to organize and come within the district after it is formed, they may petition the State Committee to do so. Districts usually take in one drainage area.

We have had one meeting, several weeks ago, at the Johnston Schoolhouse, about 36 miles down Box Elder. At that time it was decided to take in all of the Box Elder drainage area, and about 20 of us have signed a petition to organize a district. There are several of us here who were at that meeting.

Today we are fortunate enough to have Mr. Severson, our County Agent from Baker (as you know Mr. Zeidler has left the Extension Service for an easy job, running a ranch); and Mr. M. P. Hansmeier, Extension Conservationist.

These gentlemen are here to assist us, and I believe to give further information to help us decide if we want a district. If there are any questions to ask, now is the time, for I believe these gentlemen will try to answer them for us.

For those who have not heard about the soil conservation districts and the benefits that may be derived from them, I will read some history of them that I have prepared in brief form; also how they are organized. If I have made any mistakes I hope these gentlemen will correct me, for there is an old saying that "In a democracy, the purpose of information is to enlighten, and not to restrain or compel." That, likewise, is the purpose of informational activities in a soil conservation district. After people are correctly informed they will make their own decisions, as to participation. The Soil Conservation movement has the support of State and Federal agencies whose programs are concerned directly or indirectly with the conservation of land and human resources.

Soil conservation is preparedness in peace as well as war times. Water let go to waste is wealth wasted. Soil conservation applies to erosion control and prevention; it can be applied to methods of tillage, grazing, ditching, diking, reservoirs, spreader dams, contouring, contour strip farming, tree plantings, land use, economic, social, and many other problems. Really to be complete, a soil-and-water-conservation program must bring into use all of the known good, practical means of saving soil and water adapted to an area, and it must bring them into use on all of the land, not on only a segment of it; and this must be done for practical reasons, in such a way that the farmer or rancher is able to maintain or increase his income after the conservation measures are applied to his land.

Wind and rain are natural forces. They follow no pattern laid down by man. They respect neither his fence lines nor property lines. Single-handed combat with erosion is costly and can never be anything but piecemeal.

Through a soil conservation district law farmers and ranchers are permitted to organize and form soil conservation districts that will have the status of governmental subdivision of the State. The Montana Soil Conservation Districts law was passed by the 26th General Assembly.

Although Texas did not pass a soil conservation district law until 1939 that State already leads all other States in the total number of soil conservation districts voted in by landowners, and in the total acreage in the districts. Landowners approved in referendum the creation of a total of 46 districts in about 75 days from March 9, 1940, to May 25, 1940. The 46 organized districts cover approximately 44,407,976 acres and include within their boundaries more than 225,000 farms and ranches.¹ This would average 4,891 farms or ranches to a district, so they are not very small districts. The State Soil Conservation Board subsequently approved all these districts for organization and appointed two supervisors in each district. Landowners in all these districts have elected three additional supervisors to complete the five-member boards which will direct the land resource-conservation activities in each district. More than 90 percent of the total votes cast in many of the referendums favored the creation of proposed districts, and in one, Highland Soil Conservation District, the landowners unanimously voted to organize a district. These districts are not confined to any one section of the State, but instead are well distributed. That fact

is conclusive evidence that farmers and ranchmen throughout the State recognize that they have conservation and proper land-use problems and that they are eager to organize soil conservation districts for a cooperative attack on these problems.

Montana has only a few of these soil-conservation districts organized but no doubt we will have a great deal of them in the near future. Several of us were in Wibaux County, Mont., where they have a district voted by approximately 86 percent of the total vote. This district covers the whole county. They have problems slightly different from ours. Theirs is more of a farming community, while we in 1940 built 161 stock water dams, 189 spreader dams, developed 18 springs and dug 7 wells, sowed between 12,000 and 13,000 acres to crested wheatgrass, alfalfa, and sweet-clover, built a number of dikes; had tens of thousands of acres of deferred grazing—these mostly on old fields and range land. Wibaux County has done more contour furrowing, contour strip cropping, built more spreader terraces, erosion dams, etc., on cropland. Of most interest to me was a series of water storage dams for irrigation and a stock water dug-out reservoir. I will say that it is the best I ever saw. Taking it all and all I do not see why it wouldn't apply to our conditions; and I will say that Wibaux County has done good work for the short time the conservation district has been in operation.

No district can be formed unless the people want it, and then not unless they register this want first by petition and later by a favorable vote of 65 percent of the land occupiers voting in the referendum. Once the district is formed, control of its affairs rests in the hands of local people. The supervisors are not subject to any regulations from the State Committee or from any Federal or State agency. As with other cooperative enterprises their role is that of cooperation; and especially on State and Federal land, supervisors of districts will need the help of whatever agency is in position to assist them. This help may be financial, it may be in the nature of technical assistance, or in the form of seed and plant materials, equipment, etc. They will need the benefit of the discoveries of the State Agricultural Experiment Stations, and the educational services of the Extension Service. There will be engineers and machinery to bring into the district.

The bill provides for the following to be members of the State Committee: The Director of the Montana Agricultural Experiment Station at Bozeman, Montana; the Director of the Agricultural Extension Service at Bozeman; a member from the State Water Conservation Board, designated by that Board; a mem-

¹ See February 1942 issue of SOIL CONSERVATION for up-to-date figures on Texas districts.

ber of the State Grazing Commission designated by that Commission; the Commissioner of the State Department of Agriculture; and two farmer members chosen by the Governor.

The Committee supervises the formation of soil conservation districts and sets the boundaries for each district. Any individual, or group of individuals, who feels that a district is needed for the benefit of the land surrounding his home may take the first step toward the creation of a district. This interest may be signified by requesting a blank petition form from the Soil Conservation Service State Coordinator, Mr. Truman C. Anderson at Bozeman. The petition must be signed by at least 10 land owners of the proposed district. The more names on the petition the better.

After the Board receives the petition it must set a date and place, and give due notice of a public hearing to be held for an open discussion of the questions of desirability and necessity of the creation of the proposed district. Any interested party may present spoken or written opinions or testimony. If the hearing shows people are favorable to the creation of a district, the Board does not grant the right for the organization of the proposed district. The Board only accepts or affirms the petition.

The State law specifies that the qualified land occupiers must vote by secret, unnumbered ballot, on whether they themselves will create a district. Those eligible to vote in an election are land owners, their wives and others holding equitable interest in the land, and land occupiers.

The State Board, after accepting the petition for a district, and fixing its boundaries, sets the date and places for the elections and gives due notice of them.

If the formation of the district is affirmed, it is the responsibility of five supervisors to govern it, each of whom must be a land owner within the district and actively engaged in farming and ranching. The State Board appoints two supervisors who obtain from the Secretary of State a certificate establishing the district as a legal subdivision of the State, a public body corporate and politic. After the issuance of the certificates of organization the district elects three more supervisors and thereafter elects all successors as vacancies occur on the Board of Supervisors.

The term of office of all elected supervisors is 3 years; of the two appointed supervisors, 1 and 2 years respectively.

The supervisors and State committeemen receive no salary. They may be reimbursed, however, for expenses incurred in carrying out their duties.

The successors of the appointed supervisors are elected in the same manner as other supervisors and for regular terms of 3 years.

A soil-conservation district does not have authority to levy taxes or issue bonds.

The program is voluntary. Farmers and ranchers will not be forced to take part in a district program unless they decide that land-use regulations are needed and it is impossible to carry on an effective erosion-control program because a few of the farmers refuse to treat their lands. However, before land-use regulations could be put into effect, 65 percent of the voters "in a separate election after the district has been operating" would have to vote favorably for land-use regulations. They have not got the land-use regulations in the Wibaux County Soil Conservation District and it has been operating for about a year. I doubt if we would need them in this district. However, the supervisors will carry out the kind of soil-conservation program that farmers or ranchers want.

The soil-conservation work that the districts do will be financed in several ways. The land owners and land operators who directly benefit from the application of erosion-control measures to their lands furnish labor, materials, equipment, etc. The supervisors can get in machinery to operate at cost, plus a slight replacement charge. Appropriations may be allocated by the State Committee; and services, funds, and properties may be contributed by the United States Government through the Department of Agriculture or other agencies. The law provides that after a district has existed for 5 years farmers may petition to have the district dissolved.

FARM CONSERVATION PLANNING FOR WAR NEEDS

(Continued from p. 226)

This whole problem of farm planning for war needs challenges the best thinking of agriculturists. The problem is one of efficient production in accordance with needs. At the same time, we must safeguard our basic resource—the soil—for continued use. Certainly nothing can be gained by decreasing the emphasis on conservation at this time. On the contrary, increased attention to land use capabilities and conservation measures offers the best means of meeting this emergency.

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



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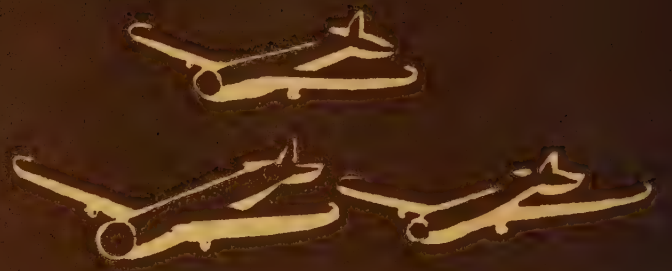
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¹ Prepared solely for official use by the Soil Conservation Service—not available for general distribution.

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Farm Conservation Planning for War Needs

By E. H. REED¹

The war, with its attendant needs for increase in production of certain agricultural products, has intensified the problem of conservation planning. First attention of the Department of Agriculture is being given to production of the farm products

(Continued inside on p. 224)

¹ Head, farm management section, Soil Conservation Service, Washington, D. C.



April 1942

**BIOLOGY and
LAND USE**

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Wildlife is in the war, too! With every inch of acreage drafted for production, Agriculture does well to consider the "extra" resources—the quail and rabbit and grouse of buffer strip and fence corner. This issue tells how to husband and encourage the vast farm wealth of fish and fowl and fur in gully and in field.

UNITED STATES DEPARTMENT OF AGRICULTURE — WASHINGTON

CONTENTS

Total Conservation:	Page
By H. H. Bennett.....	233
Food From Ponds:	
By Lawrence V. Compton.....	236
Furs—A Million Dollar Resource in an Agricultural State:	
By Sylvan T. Runkel.....	237
Fence Row Facts:	
By Charles A. Dambach.....	238
Beaver on Trial:	
By Paul M. Scheffer.....	239
Shrubs by Direct Seeding:	
By Verne E. Davison.....	242
Grasses for Soil and Wildlife Conservation:	
By Edward H. Graham.....	244
Adolph Lee Looked Ahead:	
By Wallace L. Anderson.....	251
Soil Conservation Favors Bobwhite:	
By Verne E. Davison.....	251
Ten Years of Protection:	
By Charles A. Dambach.....	252
Does Kudzu Have Wildlife Value?	
By Verne E. Davison.....	253
Providing for Wildlife in Farm Planning:	
By Homer G. Towns and Harvey D. Burkhalter.....	254
Wildlife Increased by Erosion Control Practices:	
By A. C. Hawbecker and R. M. Bond.....	255
Wildlife Management on Irrigated Farms:	
By H. P. Pratt and W. S. Long.....	257
Water for Wildlife in the Southwest:	
By A. E. Borell.....	258
Windbreaks and Their Value to Wildlife:	
By Adrian C. Fox.....	259
Planting Spoil Banks and Ditches:	
By R. E. Culbertson and Richard M. May.....	260
More Ruffed Grouse From Woodland Management:	
By Frank C. Edminster.....	261
A Story of Pond Protection:	
By Stanley W. Austin.....	262
Sterile Streams Take on New Life:	
By Howard C. Hass.....	263
Barbed Wire Conserves Soil and Wildlife:	
By Philip F. Allan and Palmer R. Sime.....	263
Deerweed:	
By R. M. Bond.....	264

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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APRIL • 1942

TOTAL CONSERVATION

AN INTRODUCTION TO THIS ISSUE BY H. H. BENNETT

CHIEF, SOIL CONSERVATION SERVICE

There has always been one basic reason for soil conservation—the extent of its contribution to the welfare of mankind. Today that welfare depends on our success with respect to the prosecution of total war. It is not enough to conserve soil and water; soil conservation must result in the utmost yield, without waste of any kind, of those products of the soil needed by the United Nations.

Since the last war we have learned that we cannot achieve maximum production on all lands unless we fit our crops to the capabilities of the land itself. This is another way of saying that it is a waste of time and effort to try to produce a high-yielding crop on low-class land, or, conversely, that first-class land is being wasted if it is supporting only low-yielding crops. Recognition of land for what it is capable of producing is a prerequisite to good planning and management. By applying to the land this principle of use classification we can get the maximum out of our farmland, and each parcel of land will produce the most it is capable of producing, with a minimum of effort. Surveys of the use capabilities of American farmland, in several hundred localities well scattered over the United States, have revealed that we cannot be confident of long-time high production from our better lands unless we produce the crops with soil-conserving measures of lesser or greater intensity, as the case demands.

I want here to focus attention upon the total of approximately 33 million acres, included within the agricultural area of the country, that are clearly unfit for the production of cultivated crops, hay, pasture, or trees. This area is as large as the entire State of New York. We cannot afford to let this much land remain idle; nor can we waste fertilizer and effort trying to produce crops it is incapable of supporting.

Some of the land within these 33 million acres has been so gutted by erosion that even trees will not grow on it. Obviously, such land cannot be converted to woodland. Some of it is in critical positions where cultivation is out of the question and pasturing is unwise because of a high erosion hazard. The banks of streams, drainage ditches, and irrigation ditches, for in-

stance, ordinarily cannot be farmed, even though they may amount to several acres of wasted land per mile, and to millions of acres in the aggregate. A great deal of marshland, incapable of being drained economically, occupies an appreciable total area, especially in the eastern United States. Finally there are the inevitable infertile spots and unproductive alkali areas commonly interspersed throughout good arable land.

Farmers know these infertile spots well. They include areas of shallow soil underlain by claypan, hardpan, rock, or gravel; small sharp breaks that cannot be farmed without damage to good land occupying lower levels; soggy spots that cannot be drained with any degree of practicability; salty lands that cannot be reclaimed economically; and many kinds of unusable rocky outcrops, sinkholes, and rough areas. Mostly small in size, these odd spots are worthless to agriculture, and any attempt to use them for crops is a waste of labor that ought to be devoted to more productive land.

These apparently worthless areas contribute their full share to the soil losses of the country. We suspect, in fact, that they may contribute more than their share, because many of them are extremely critical areas where erosion is more than usually active. Fortunately, however, it has been demonstrated that erosion on these wastelands can be controlled. The problem now is: How can they be made to produce a profitable crop with safety to the soil? As it happens, there is a crop that is especially adapted to the small areas scattered through better land—one that can be produced by simple treatment. The crop is wildlife. And the 33 million acres of so-called wasteland—because it cannot be more intensively used without waste—is properly designated as wildlife land.

In ordinary times considerable emphasis has been placed on methods designed to produce wildlife, in some instances almost as an end in itself. But these are extraordinary times; and, just as we demand the utmost of each man and factory, we must also require that wildlife resources play their full part. We must, of course, accomplish this purpose without damaging our capital stock of wildlife or of wildlife land.

Already about 70 percent of the wild fur crop is produced on farmland. On the other hand, all the fur produced in the country in normal times is no more than the amount we imported in former years. Most of our imports came from countries now dominated by the Axis, and the disruption of shipping may shut off all or most of our imports. Furs are needed by our armed forces, by certain important industries, and of course by the civilian population. We must have furs, and it is logical to improve wildlife land in ways designed to encourage fur animals. Specialists studying fur animal production tell us that land capable of supporting muskrats—and this includes stream and ditch banks as well as marshland—can be made to produce three times the number of animals they do now. These specialists also remind us that the muskrat is the number-one fur animal in this country.

In the tens of thousands of farm ponds designed to control erosion and provide water for livestock, fish can be produced by the millions of pounds. This is a source of food given little consideration until recently. Fish provide food elements valuable in any diet, but especially

so in parts of the country where protein food is not as plentiful as it should be. Experiment station work in the South has developed means of producing 400 to 600 pounds of fish of good quality, such as bass and bream, per surface acre per year. At this rate one small pond of an acre or two can produce enough fish under modern management to supply a family of moderate size throughout the year. Since the production cost is 3 to 6 cents per pound, however, certain types of bottomlands probably should be re-appraised to determine where ponds should be developed.

In one way it is fortunate that wildlife land consists of small areas scattered through better classes of land: The vegetation used to protect them provides homes for enormous numbers of insect- and rodent-destroying birds and mammals. The resultant benefit to agriculture is of course obvious, and so much the greater because the wildlife land is so well distributed. Among the animals thus encouraged are game birds that can afford recreation that may be needed in the long pull ahead.

Wildlife can play its part in many other ways—but I am in no position to tell the biologists how to do their job. They tell me, however, that the productivity of wildlife land depends on proper use of all land, and that soil-conserving measures on all kinds of land are necessary for maximum production of wildlife. Here, I am on firmer ground, for I mean to do all that I can to see to it not only that wildlife land is put to good use, but that every kind of land produces the most possible with the least waste.

I often wonder if people really understand what total war means. Total war to me means utilizing efficiently and safely to its ultimate every resource we possess—labor, land, water, timber, minerals, wildlife, to say nothing of armed human resources. We Americans were terribly concerned a while back with the energy that was bound and idle when strikes were threatening our defense program. The strikers constituted only two and one-half percent of the men and women who were exerting their strength in similar work. More than three percent of American agricultural land is idle, wasted, and misused. This entails a dissipation in the amount of farm labor available for productive endeavors. Sensible management of wildlife land is fully as essential as management of any other kind of land. Let us then use all of our lands without waste, and require that they contribute their full share to the successful completion of the task upon us.

It is our earnest desire that all people understand that the agricultural conservation program does more than benefit the farmer through adjusting the production of crops to provide an abundance for domestic and export demands and in conserving our soils. The benefits extend to all industries supplying farmers with goods and to all who are interested in the maintenance and improvement of the soil, woodlands, streams and lakes, and of the living creatures of field and forest.—R. M. EVANS.

FOOD FROM PONDS

By LAWRENCE V. COMPTON ¹

Total war to the Axis nations means utilization of every available resource. A specific instance involving fish production provides food for thought in this country. Resources in the United States are enormous, but they must be developed and utilized if they are to be totally effective.

ONLY a year ago the German Food Estate held a 2-day meeting in Berlin under the auspices of the Reich Union of Fisheries. The principal speaker was Dr. Roehler, Manager of the Union, who emphasized the importance from the point of view of fish culture of the new territories that had been incorporated in the Reich. It was estimated that through the addition of incorporated territories, the fishing grounds in Germany had been increased by 60,000 kilometers of streams, 100,000 hectares of lakes, and 40,000 hectares of drainable ponds. As a result thereof a sharp increase in fish production was expected.

This provides only an inkling of the importance that is placed upon inland fisheries by a nation in a time of all-out war. As a matter of fact, the growing of warm-water fishes, for both home and market, is an industry that has been practiced for many generations in Europe and is centuries old in the Orient. In Japan alone there are in excess of 100,000 establishments conducting fish culture in private waters, and the annual income from these ponds, lakes, and marshes is more than 3 million dollars. The ponds in the vicinity of Manila annually produce more than 3 million dollars worth of fish. Pond culture has reached an advanced state of scientific perfection in Europe, particularly in Germany and France. Not only does fish form a staple article of diet in all these countries, but the farmers regulate their seasonal production much in the manner that we do that of our fancy vegetables. Thus they are able to place their product on the market at seasons of demand such as at Lent, or at times when the production from natural waters is low.

These are countries of large populations, high land values, and intensive agriculture, yet it is in these that fish culture has reached its highest development. This is not due so much to an exceptional appetite for fish as it is to the fact that fish are an economical source of protein and that the raising of fish is a profitable use of the land. In these regions fish raising is often used as part of a crop rotation, with the field

diked and flooded to form a pond. However, most of the fish culture is done in permanent, drainable ponds that are planned and managed for a maximum fish production. Even so, many of these ponds are used for stock water, boating, and swimming.

The farm pond offers the American farmer the opportunity to engage in fish culture and thereby increase the yield of his land, improve his family food supply, and augment his cash income. Relatively few farm endeavors offer so much in return for so little effort and investment. The main function of most farm ponds is the provision of a reliable source of stock water, but if properly built and managed, these ponds can be the source of many other benefits. Pan fish may be raised in them, and in an abundance. In some regions, ice may be cut and stored for summer use; in other regions the water from such ponds may be used to irrigate gardens. Everywhere, the farm pond is a useful tool in the control of erosion and floods, and in the regulation of stream flow.

Although the idea of using the farm pond as another field from which to harvest a food crop is not widespread in the United States, it is not an untried one. In the mountain States of the West many a rancher has for years been raising trout in his ponds for home and market. Some of these ranchers actually have gone into the resort business because their farm ponds were such good fish ponds. The propagation of bait fish, game fish, and gold fish has long been a profitable private industry in many parts of the country.

In recent years considerable effort has been made to gather records of pond productivity. Several artificial ponds in Illinois were found to have an average annual yield of more than 200 pounds of fish per acre. One of these ponds produced 377 pounds per acre. From natural ponds in Colorado, 100 pounds of fish per acre were taken annually by hook and line. A fish inventory of 17 ponds in Michigan, Illinois, Alabama, Louisiana, and Nova Scotia revealed that the average standing crop was 275 pounds per acre. These are productivity figures for unfertilized ponds; experimental evidence indicates that the productivity of a pond can be more than doubled with fertilization. In the South, an average, untended farm pond will produce

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about 150 pounds of fish per year, but with fertilization such a pond will annually produce 400 or more pounds of fish.

Protein is essential to human welfare and it is desirable that a portion of the protein be of animal origin—eggs, milk, cheese, meat, or fish. It so happens that pond fish, such as bass, perch, and catfish, are higher in protein content than beef, pork, or mutton. A pasture of just average quality will produce annually approximately 150 pounds, live weight, of cattle or sheep. Fish production of nonfertilized ponds is approximately 200 pounds per acre. Cattle and sheep dress-out at approximately 55 percent of live weight;

fish dress-out at 65 percent. Thus an acre of pasture may produce 85 pounds of beef or mutton and an acre of pond produce 130 pounds of dressed fish. If the pond is fertilized the production may be 260 pounds of clean fish.

Pond culture is, in reality, simple and inexpensive, but, like any other agricultural endeavor, it requires some attention and work. Nevertheless, pond fish can be produced with no more effort than is required by a vegetable garden. Building farm ponds and using them for fish production as well as other purposes will also provide the farmer a more abundant and interesting year-round occupation on his land.

FURS—A MILLION DOLLAR RESOURCE IN AN AGRICULTURAL STATE

By SYLVAN T. RUNKEL ¹

Enough fur to supply all our needs has not been produced in the United States since pioneer days. War has simultaneously expanded the demand and cut off our foreign supplies. Some 70 percent of the wild fur crop is trapped each year on farms, and simple management measures applied to the wildlife lands of agriculture could increase this figure substantially.

IOWA is primarily an agricultural State with 95 percent of the land in farms and only 3 percent in woodland, but its fur business yields to hunters and trappers almost a million dollars a year. The income was \$718,330 in the 1935-36 season and \$979,482 in 1940-41. Most of the trappers are farmers and farm boys.

In fur resources, Jones County is fairly representative of Iowa's 99 counties. It is significant that this highly specialized agricultural county produces from \$8,000 to \$10,000 a year in furs without the benefit of a game management plan and with only the protection offered by closed seasons. The accompanying table shows the kinds, numbers, and value of furs taken in Jones County during the winter trapping season of 1935-36, a season that is considered average. These data are from the records of the Iowa Conservation Commission.

Muskrat furs made up more than half of the return in Jones County, although marsh land is almost nonexistent. The majority of muskrats must have been trapped along streams running through farm land. This year the value of a muskrat pelt is about \$1.60; if this price continues and the catch is average, the returns for the county in muskrat furs alone will be approximately \$7,800.

Kind of animal	Pelts	Value per pelt	Total value
Raccoon.....	160	\$3.95	\$632.00
Opossum.....	434	.32	138.88
Muskrat.....	4,902	.98	4,803.96
Mink.....	275	5.93	1,630.75
Skunk.....	602	.91	547.82
Civet.....	228	.31	70.68
Badger.....	1	5.12	5.12
Weasel.....	22	.55	12.10
Grey fox.....	8	2.00	16.00
Red fox.....	38	2.95	112.10
			7,969.41

No large-scale effort has been made to develop the county wildlife resource, but the Soil Conservation Service is assisting farmers and local and State agencies in developing complete farm plans including provisions for wildlife food, cover, and water, and protection of the valuable stream banks. A few State game management areas recently were established by farmers cooperating with the Conservation Commission and the Soil Conservation Service.

THIS ISSUE'S ARTISTS

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FENCE ROW FACTS

By CHARLES A. DAMBACH¹

Fence rows can't be farmed, but they can be managed for the benefit of adjacent crops. Each 2 miles of clean fence row amounts to an acre of wasted land that could be used to improve biologic conditions on farmland. Simple ways to make these thin strips of land useful in agriculture form the substance of this article.

IN Indiana and Ohio there are approximately 750 rods of owned fences for each 100-acre farm. The average width of clean fence rows is about 4 feet; brushy fence rows and Osage orange hedges vary in width from 4 to 20 feet. If all fence rows on a farm are clean they occupy approximately one percent of the land; if all are brushy they occupy from two to four percent. Two miles of clean fence row equal an acre of land; a brushy fence row occupies from one and a half to four times this acreage.

Some farmers take pride in keeping their fence rows clean, the same sort of pride others have taken in straight furrows—even though they be up and down hill. Plowing with the property fence lines instead of with the land, has caused a considerable amount of erosion. Fence rows on the contour, permanently vegetated, become erosion buffer strips and contour guide lines that aid in retarding erosion; and, to appear neat, a fence need not be bare of vegetation. Fence rows of bluegrass sod or of low shrubs add much to the attractiveness of a farmstead. They also can be used to produce low-growing fruits and nuts such as blackberry, plum, cherry, hazel, and grape, and decorative plants as bittersweet, winterberry and Christmas trees.

In the agricultural sections of Ohio and Indiana, the amount and distribution of fence-row vegetation probably affects farm wildlife more than any other factor. There are many more birds on farms with woody fence rows than on similar farms lacking such cover. In Ohio, it was found that there were 32 times as many songbirds in shrubby fence rows as in open crop fields. Even clean fence rows of bluegrass supported nearly 7 times as many birds as open cropland.

Few of the insects found in fence rows are crop pests; most of them are harmless; and about a third are beneficial. For example, in Ohio there were 60 times as many aphid-eating lady beetles in Osage orange hedges and shrubby fence rows as in bluegrass cover. On many farms, permanent fence rows are the only places where beneficial insects, such as lady beetles,

assassin bugs, and damsel bugs, can live undisturbed from year to year. The recommendations of entomologists to clean up fence rows as an insect control measure have been grossly misunderstood. Such control for specific pests is sometimes necessary, but not in all fence rows in all farming districts.

Mice abound in woody fence rows, but, fortunately, they usually are not the kinds that attack crops. Although meadow mice are abundant in heavily sodded grass borders, they do not find woody cover to their liking. However, woody cover provides homes for predators, as shrikes, sparrow hawks, skunks, and weasels that feed on rodents generally. Beneficial small mammals, like the short-tailed shrew and least shrew, live in fence rows as well as in crop fields.

Most of our common crop weeds are annual or biennial plants, but the perennial plants of permanent Ohio fence rows are not weed species. Annual and biennial plants stand little chance of becoming established under the shade of shrubs and trees or in fence rows of vigorous plants such as bluegrass.

Burning fence rows to control weeds, insects, or rodents usually fails to accomplish its purpose. By the time weeds are dry enough to burn, their seed have ripened and scattered, and their roots are too deep to be harmed. Few injurious insects are destroyed by burning and most entomologists have discontinued recommending this practice except for special purposes. Rodents in fence rows can easily escape from fires by remaining in underground runways or by moving into adjacent fields. Burning may do much harm; even a grass fire may be hot enough to melt the protective zinc coating on fence wire and metal posts, and to set fire to wooden posts. Fires also destroy beneficial insects and homes for insectivorous birds.

Fence rows are a necessary part of the farm pattern, but too often this part, small as it is, has been badly misused. Like every other acre, fence row acres should be put to their best use. We need to cast off old ideas about the fence row and manage it purposefully as an important element of the farm.

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Scientists estimate that in primitive times the dams of 60 million beavers held back flood waters in what is now the United States. Exploited for their valuable fur, beavers have been reduced to a very small fraction of their original numbers, but with the help of many conservation agencies, these animals are coming back.

THE judge took his place at the bench. He spoke, "I find the defendant—not guilty!"

The true defendants of the case were not in court to hear their acquittal, but when word of the court's decision reached the wilds of the State of Oregon in the late evening, it might be imagined that the nocturnal silence of the wilderness exploded with the thunderous report of beaver tails slapping the dark waters in celebration. The beavers had been on trial and they had been set free!

This figuratively interpreted but actual court case was tried in Oregon in October 1939. Since then, requests have come from various parts of the country for full light on the probably unparalleled litigation involving the right of the flat-tails to live and work and enjoy their watery homes. Meanwhile, the beavers whose fate hung in the balance before the Oregon Court have thrived and multiplied—but that is a bit ahead of the story.

Actually, the right of a landowner to protect his land from the ravages of soil erosion with the assistance of a colony of beavers was subjected to court decision. The history of this unique case takes us back to the year 1884, when title to the land was acquired by a pioneer conservationist, C. W. Carey, through homestead from the Government. Carey sold the place to Paul C. Stewart in 1924, and Stewart later bought adjoining range lands. Part of this land was in meadow subirrigated by Crane Creek, a stream that coursed

BEAVER ON TRIAL

By PAUL M. SCHEFFER ¹

through flats of stirrup-high native grasses. Subirrigation was aided by several families of industrious beavers that had built numerous dams across the stream to form ponds for their homes. It was a productive ranch.

Forty years later, this picture suddenly changed. In 1924, Stewart left his farm for a year and, upon returning, found that poachers had trapped the beavers from his stream. The dams, no longer attended, had washed out. The unchecked stream ran wild. The washing out of the unattended beaver dams was not a remarkable phenomenon in itself, but more startling events followed in rapid order:

In 1925 flood waters raged through the meadow lands cutting into the nonstabilized stream channel, and erosion began.

By 1930 the stream channel had cut to a depth of 10 feet. Sloughing banks ate farther and farther into valuable crop land.

In 1935 the stream was flowing 15 feet below its original level. The water table in the adjoining meadows was dropping correspondingly.

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By 1936 the valuable hay lands had been nearly destroyed.

One morning Paul Stewart stood at the edge of the stream gazing into a miniature canyon. It was a discouraging sight. Twenty feet below him, a small stream found its way around huge blocks of soil that had fallen from the banks. Only 11 years before, he had been able to drive his team across this waterway—protected then by beaver dams.

Stewart turned toward his meadow lands. More desolation. Dust, stirred by the hoofs of a few range cows, rose and settled over a near-barren waste broken only by clumps of encroaching sagebrush and sparse remnants of the original grasses. Other cattle stood at a tank, drinking the last water that a pump had been able to raise from the once abundant supply of the well.

Something had to be done! Engineering assistance was needed. Paul Stewart reasoned that if beavers had protected his land once, they could do it again. He sent an emergency call to the Oregon State Game Commission. Later that year, 1936, 16 of nature's best hydraulic engineers—the beavers—were placed on the farm at Stewart's request.

The beavers began their reclamation work at once. They erected strong dams almost overnight; they sent cottonwoods and aspen crashing into the gully; they built more and more dams. When the heavy spring run-off came, water that for the past 12 years had rushed through the stream channel to be lost in the river below was caught behind the beaver dams and held in large ponds. The ponds acted as settling basins for the silt-laden waters and at each flood stage inches of soil were added to the bottom of the deepened channel. As the ponds filled, excess water filtered through the dams and continued down the stream. The average summer stream-flow of the preceding 12 years was increased considerably by the water escaping from storage. Water from the ponds percolated into the edges of the adjacent fields. In only 2 years, the picture of desolation began to change. Hay production in the meadows increased. The well again supplied ample stock water. The ugly erosion scar through the meadow was healing.

Spring and summer rains in 1939 were not plentiful in Harney County, Oreg. The high range lands were not as green as they had been in previous years. Stockmen knew that their livestock would have to be brought in early in the fall to be fed from supplemental stores. Watersheds were unable to feed normal supplies of water to the lower lands. Irrigation water was at a premium.

Paul Stewart was fortunate. His beavers had been working night after night to impound a water supply

that would keep his hay meadows green and productive. The beaver ponds had raised the water table to the roots of the alfalfa and native grasses. Stewart's livestock would have plenty of feed for the winter.

Lloyd Johnson, neighboring rancher, living below the "reclaimed" Stewart ranch was not so fortunate. His meadows had drained into deeply gullied stream channels that were not protected by beaver dams. He would have to set his sickle bar pretty low to get even one cutting of hay this year. Sagebrush was invading his fields, too. What he needed was more water.

One day, while watching the trickle of water running through the gully in his meadow lands, Johnson decided to investigate. He knew of the beaver ponds on the Stewart ranch, and wondered what the water situation was on his neighbor's place. After a short walk along the creek, Johnson arrived at the lower outpost of the beaver stronghold. The sight that greeted him stopped him short—for he saw green native hay, fields of knee-deep alfalfa, and abundant water behind strong dams.

Johnson then decided that the salvation for his own crops, suffering from lack of water, was to drain the beaver ponds. If that were done then the water would flow on to his place. As shown later at the trial, Johnson did not foresee that little would be accomplished by draining the beaver ponds, or that the unchecked water would flow through his land to the river beyond. He discussed the matter with Stewart, who refused to dynamite the dams.

"Why," Stewart pointed out, "if those beaver dams were blown out, after the ponds had drained you wouldn't have any more water than you have now, and my ranch would go back to sagebrush."

The question remained whether Stewart had the legal right to impound more water than he had filed rights on, even though he was protecting his land. That, in effect, is what Johnson told officials when he obtained an order for Stewart to show cause why he should not release the beaver-impounded water. Johnson was in desperate need of water, and it was now a matter for court decision. The beavers were on the spot!

The case was brought to the circuit court in Harney County, and Stewart now becomes the actual defendant in the story. Johnson contended that Stewart was violating his decreed water rights. Stewart's counsel replied that the defendant was within his legal rights in protecting his property from the ravages of erosion by the use of beaver and beaver dams. "Furthermore," Stewart's attorney argued,

"as a result of the beaver operations, more water is now available to the plaintiff (Johnson) than the plaintiff has filed rights on."

The circuit court, in June 1939, ruled that Stewart had violated the court's earlier water-rights decree, granted Johnson a judgment for \$500 damages, and ordered Stewart to have the State Game Commission remove the beavers from his property and to take their dams out of Crane Creek. Stewart also was ordered to pay a \$300 contempt find and was given 5 days to comply with the court's order, subject to 3 months' imprisonment in the Harney County jail if he failed to do so.

The beavers had been given what amounted to their death sentence! The thousand years' work of their ancestors in helping to shape fertile valleys was unrecognized and their importance as flood-control and reclamation "engineers" had again been overlooked. But Paul Stewart, reluctant to accept as final the decision of his fellow man, appealed to the State supreme court. The appeal was granted and new hope was held for the beavers who were now to have a second chance.

The Oregon Supreme Court convened in October 1939 and the case of *State of Oregon ex rel. Lloyd L. Johnson v. Paul Stewart* was presented for argument. Although the beavers, the true defendants, were not present at their trial, they were ably represented by competent lawyers. Stewart's counsel began his argument:

"The question of soil erosion in this case," he stated, "is of national importance and the decision of this court will affect every erosion-control program in the Nation. This court must decide whether or not the landowner has the right to protect his chattel from destruction by erosion."

For more than an hour the court listened to his argument. "All my client wants," Stewart's counsel finally concluded, "is the right to protect his land!"

Johnson's attorney opposed the defending counsel with, "It is peculiar that the court should be listening to a soil-erosion case when it is not the true issue. Soil erosion is being used here as a subterfuge." Then he continued thus: "Mr. Stewart has retained water on his property that belongs to Mr. Johnson. Soil erosion wasn't even heard of when the water-rights decree was written. We are just now beginning to get erosion conscious."

Came time for the opinion of the higher court, the significant ruling that reversed the eviction order against the beaver along Crane Creek:

"After giving the matter our best consideration, we think that defendant would have the right to construct dams or permit them to be constructed by beavers to control the erosion, without diverting the water over the land or from the diversion works of another appropriator, and restore the bed of the stream to its original condition as near as may be, if he can do so without materially interfering with the right of the lower appropriator, Johnson."

Then the court added: "To deny our water users the right to control such streams and prevent the erosion that would soon take place would mean the utter destruction of much of our most valuable lands throughout the State. It is the duty of the landowner to prevent the construction of dams to a point where diversion from the channel will occur, but the landowner has the right to use or permit such dams for the purpose of erosion control, where they will not divert water from the channel or from the diversion works of another appropriator. It is shown that if the erosion is permitted to continue the water would be drained from the lands bordering on the creek and they would become dry and worthless."

Epilogue

Paul Stewart since has sold his ranch, but the beavers are still on the property and there has been a noticeable increase in the size of the colony.

"There are more than 150 beavers on the place now," Stewart reported, "and a number of large dams have been built in the creek channel running through the meadow and hay land. Most of the beaver dams are located above the cultivated land. You can see scores of them up there. The thing that pleased me most was the effect the beaver dams had on the water table of my cultivated lands. The level of the ground water was raised, and I got at least a 50-percent increase in my hay, grain, and alfalfa crops during the last 3 years I operated the place. Those beavers were worth plenty of money to me."

"I know that Johnson is getting more water now and for a longer season than he has for many years," Stewart observed in answer to a question. "I am sure the beavers had something to do with it. By now they should be down on his place too, if they have not been molested. You should see the creek channel on my old ranch now. Places that used to be 20 feet deep have silted up to within 3 or 4 feet of the top. Oh, there are still some spots where the channel is plenty deep, but the beavers are on the job and have it under control."

SHRUBS BY DIRECT SEEDING

By VERNE E. DAVISON¹

Planting nursery-grown shrubs takes a lot of labor, and labor is scarce these days. In the Southeast a way has been found to establish certain shrubs by direct seeding. The simple and inexpensive way to do it has been perfected during 4 years of field-scale trial.

SHRUBS are essential to the welfare of common kinds of farm wildlife. It is from the vantage of shrubby coverts that quail and pheasants forage through the fields, and perching birds capture insects over the crops. Shrubs are dependable havens from weather, predators, hunters, and farming operations. With this in view, problems arise as to suitable places for shrubs on ordinary farms, methods for establishing shrubs, and species to be used.

Shrubs belong on stream banks, in woodland borders, in fence rows, in windbreaks, in hedges, and over rock outcroppings and similar small areas that are not suitable for crops, pasture, hay, or woods. Agriculturists have not fully accepted this fact because simple methods of managing shrubs are not widely understood. Usually shrubs have been established by transplanting wildling or nursery grown stock. This is a cumbersome and expensive method that may be eliminated by direct seeding.

Among the woody plants most successfully grown by broadcasting or sowing the seed are the shrub lespedezas which have several promising features for farm use. They are easily kept in place because they do not spread by root suckers and do not seed into hay or grassland. Burning or cutting back to the ground does not kill them. The purple flowers produce honey, and quail eat the seed readily. *Lespedeza bicolor* is the species that has been used most widely; a second species, *Lespedeza cyrtobotrya*, appears to be equally promising for more northern conditions.

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A serious problem of land management is always present in the Eastern States because the climate naturally favors woodlands—trees encroach on every acre that is not cultivated, mowed, or closely grazed. Shrubs, therefore, should be established in solid stands without open spaces into which trees will seed. The old style of planting shrubs 6 by 6 feet does not satisfy this requirement. Even 2 by 2 is not too close. However, 6 by 6 spacing requires 1,200 plants per acre; 2 by 2 takes almost 11,000; and \$2 per thousand is about as cheaply as plants can be produced. The labor to plant so many seedlings is no small additional expense. Furthermore, plantings failed to give complete ground cover and erosion control. On the other hand, 8 or 10 pounds of seed per acre will produce more than 50,000 living plants of shrub lespedeza, more than 1 per square foot. In the Southeast considerable success has been attained in establishing 2 shrub lespedezas simply by sowing the seed.

To obtain sufficient seed for widespread use, a small seed production block of the two shrub lespedezas was set out in 1935 at the Soil Conservation Service nursery, Rock Hill, S. C. The plants had been grown in pots from seed the year before. Approximately 4 million seedlings were planted in Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Virginia during 1937, 1938, 1939, and 1940. Survival was high and the plants bloomed and produced seed. It was evident that the direct seeding of shrubs offered the most promising means of establishing thick stands at reasonable cost, and nurserymen maintained that shrub lespedezas were more

A bird's-eye view of a well-managed field discloses the extent and neatness of a field border between the tilled crops and the woodland—a border that checks erosion, serves as a turn row for teams, and provides a place for wildlife.





Three-year-old lespedeza bicolor from direct seeding forms an inexpensive border between crop field and woodland on a Florida farm.

easily grown from seed than other shrubs. Sufficient seed was available from the 1937 harvest to test the dates and rates of seeding, also to determine the ability of the plants to survive without cultivation and in competition with annual grasses and weeds that volunteer following seedbed preparation. Consequently, in 1938 the seed blocks at Rock Hill were enlarged and new ones planted at Chapel Hill, N. C. and Sandy Level, Va.

Satisfactory stands survived and the tests were made again in 1939. In addition some 60 trials were made at different field locations widely scattered in the 7 Southeastern States. By the spring of 1940 there were 1,137 pounds of seed for field use and 487 separate seedings were made. The demonstrations in 1941 received 1,308 pounds of seed and accounted for an additional 160 acres on 500 farms. In the autumn of 1941 the 1938 plots reached third-year maturity, the 1939 trials showed promise after 2 years, and the 1940 demonstrations further proved dependable germination and first-year survival. This was conclusive evidence that direct seeding produced better results with shrub lespedezas than the planting of seedlings or transplanted stock.

The 1,146,000 plants grown in 1940 at Soil Conservation Service nurseries were withheld from erosion control plantings and the practice of using seedlings was abandoned. Instead, the shrub lespedezas were allotted to soil conservation districts for establishing local seed production blocks and a policy of direct seeding was established.

Shrub lespedezas may not be the answer to the problem of shrubs for farm wildlife, but they have demonstrated that direct seeding is possible. Time and continued effort is required to develop practical methods of seeding other species of shrubs, and such studies are being advanced together with further work on the shrub lespedezas. More important, however, is the proof that agriculturists are willing to accept

shrubs in land-use patterns when the method of establishment is simple, direct, and economically feasible.

Seeding Specifications

To establish shrub lespedezas by direct seeding, broadcast 8 to 10 pounds per acre on a well-prepared seedbed, any time within 60 days after the last spring frost.

The plants may seem discouragingly small the first year, when they reach a height of no more than 3 to 12 inches. Growth the second year is ordinarily rapid after early August when the plants reach knee, waist, or even shoulder height before frost. Mature plants should be 6 to 10 feet tall in the third or fourth year.

To obtain tall plants during the first 2 years, sow in rows at 1½ to 2 pounds per acre, in rows 3 to 5 feet apart and cultivate. Moderate fertility is needed, particularly phosphate and, on sandy soils, potash.

Seed production in cultivated rows is negligible the first year; the second it should be 50 to 100 pounds per acre; the third year 150 to 200 pounds per acre can be expected. Selected strains and improved harvesting methods increase yields even beyond this figure.

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Fish in the Dust Bowl

During 1941, as part of a program to utilize agricultural resources to a greater extent, thirteen soil conservation districts in the Southern Great Plains region obtained more than 50,000 fish from Federal and State hatcheries. With this supply they stocked 116 farm ponds.

GRASSES FOR SOIL AND WILDLIFE CONSERVATION

By EDWARD H. GRAHAM ¹



Grasses have always been of primary importance to man. That they provide first-class cover as well as food for wildlife is less well known. A summary account here points to many soil-conserving grasses that provide for wildlife welfare.

Grasses and Soil Conservation

IT IS not surprising that the grasses, so important to the farmer and his domestic livestock, should also be of great value to the soil conservationist and wildlife manager. As erosion-control plants the grasses form a dense, protective soil cover rivaled by few other types of vegetation. In the South, engineers find Bermuda grass sod highly effective for lining channels of waterways and terrace outlets in the water disposal systems that result from coordinated farm plans for conserving soil and moisture. In the southern Prairie States sloughgrass and prairie cordgrass are correspondingly adapted, and farther north Kentucky bluegrass and redbud serve the same purpose. In southern California an African importation, the spreading Kikuyu grass, is holding soil on outlet channel slopes exceeding 12 percent. In the Northwest, slender wheatgrass and seaside bent are similarly employed; while western wheatgrass and several bromes in the Great Plains, and vine mesquite in the Southwest, display the same useful characteristics.

American beachgrass, European beachgrass, and species of *Redfieldia* and *Calamovilfa* have long been valuable for controlling drifting sand. Sand bluestem is employed to hold blowing soil in the central Great Plains, and in the Dust Bowl cultivated grain sorghums are the first plants called into play to stabilize dunes caused by tilling crops on soils too light to support them permanently. In the West the Asiatic crested wheatgrass, western wheatgrass, the gramas, and other native species are much used for reseeding range lands. Giant wild-rye and Canada wild-rye are vigorously

growing perennials used for erosion control in the Great Plains. Grasses are frequently planted with legumes to form soil-holding and soil-improving mixtures for forage in pastures, for cover crops in orchards, and for winter cover on crop fields. They are also used for field border plantings to control erosion between woodlands and crop fields, and for checking erosion on highway embankments.

Conservation practices involving use of grasses are known to exert a beneficial effect upon wildlife. Studies in the Southwest show that areas on which grazing was controlled for only 2 years supported a bird population approximately twice that of adjacent areas where grazing pressure by domestic stock remained unchanged. Likewise, in Ohio, the number of pairs of ground nesting birds in the meadow strips of strip-cropped fields has been shown to be about double the number existing in solid meadow fields of the same size under comparable conditions.

Grasses and Wildlife

More than 250 species of grasses in the United States, both native and cultivated, are known to provide food for nearly 300 kinds of wild mammals and birds. The accompanying table lists the 24 grasses most used for food by wildlife, according to records of the Section of Food Habits Research, United States Fish and Wildlife Service. Many game birds, as ring-necked pheasants, quails, and other gallinaceous species eat quantities of grass, both blade and seed. In the Southeast grasses are the first-ranking food of the mourning dove throughout most of the year; and in Arizona grass seeds rank second only to those of legumes as food for the Gambel quail.

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Grasses furnish about 15 percent of the yearly food of the California quail, and are so important to snow and blue geese during the winter stay of these birds in the Gulf Coast marshes of Louisiana that a management measure for their benefit is the burning of old dry vegetation to make young tender leaves available.

Grasses of wet places offer both cover and food for waterfowl. The shoal-water ducks make use of wild rice and barnyard grass, and eat quantities of cultivated corn, sorghum, barley, and rice. Rice cutgrass, bristlegrass, and mannagrass are also consumed by these birds, while saltgrass has value on the Pacific Coast. Grass seeds are eaten by many songbirds, among them the cardinal, whose food is three-fourths vegetable, chiefly seeds of weedy plants like bristlegrass, crabgrass, barnyard grass, and sandbur. One-third of the diets of Savanna, chipping, and field sparrows, and about half the food of the tree sparrow consists of grass seeds. Numerous rodents use grasses for food as well as for nesting materials, although many of them eat far more insects than commonly supposed. Hoofed mammals such as the antelope and buffalo are primarily grass feeders. Even deer and elk, though fundamentally browsing animals, consume considerable grass and other herbaceous vegetation.

Just as woodlands and shrubby thickets provide shelter and nesting sites for some animals, so grasslands and small grassy areas furnish habitat elements essential to the survival of others. Vesper, Savanna, and grasshopper sparrows, meadowlarks, horned larks, and bobolinks nest in grassy fields and meadows. Game birds such as the bobwhite, ring-necked pheasant, and prairie chicken prefer grassy spots for nesting, and migratory waterfowl depend in large measure upon such places. Other birds that nest in grass are avocets, willets, curlews, pipits and even some birds of prey, as the marsh hawk and short-eared owl. Many small mammals live in grassy areas and, although cover is usually considered to be concealing and protective, the bison and antelope find protection in grassland which although it does not conceal them at least reveals their enemies to them.

Cereal Grasses

The grasses that provide most food for man are also eaten most by wildlife. Corn is consumed by nearly 150 wild animals; no other plant is known to be eaten by so many species. Many game birds, as the ring-necked pheasant, mourning dove, bobwhite, and numerous kinds of ducks as well as mammals such as the raccoon, make extensive use of corn, so that farmers who wish to encourage wildlife frequently

leave a few rows or shocks of this grain near patches of cover during the winter. Wheat is consumed by 120 kinds of wildlife and oats by 109. Barley, rice, rye, and millet are also eaten by a great many birds and numerous mammals.

Cultivated grain sorghums, of which there are many varieties, as milo, feterita, and Sudan grass, are food of more than 30 kinds of animals. Although not a cereal in the sense of being an edible grain, Johnson grass (*Sorghum halepense*), now gaining favor as an erosion-control and forage plant, furnishes good wildlife cover and is eaten by a dozen birds, including the bobwhite. The related native Indian grass (*Sorghastrum nutans*), however, is apparently not eaten by wildlife.

Panic Grasses

The group of grasses affording the greatest number of species useful to wildlife for food is the genus *Panicum*, which includes many grasses of high forage value. Most widely useful to wildlife is witchgrass (*Panicum capillare*), known to be eaten by 35 birds, including the bobwhite, scaled, valley, and Gambel quails, ring-necked pheasant, and several ducks. Fall panicum (*P. dichotomiflorum*) stands second; a dozen birds, among them bobwhite, mallard, and American pintail, make use of it. The creeping vine-mesquite (*P. obtusum*) of the Southwest, a stoloniferous soil-binding plant, provides food for wild ducks, and switchgrass (*P. virgatum*) is used by a half-dozen kinds of wildlife. Hall's panicum (*P. hallii*), although recorded from the stomachs of only four birds, is a favorite food of the Gambel quail and scaled quail; these birds also consume a great many seeds of Arizona panicum (*P. arizonicum*). Browntop millet (*P. fasciculatum*) and broomcorn millet or proso (*P. miliaceum*), popular for wildlife food patches, are eaten by 5 and 7 birds, respectively. Texas millet (*P. texanum*) is eaten by the mourning dove. A number of other eastern panic grasses provide valuable food for the bobwhite, and all in all, seeds of at least 40 kinds of *Panicum* are known to be eaten by more than 100 birds and 20 mammals. On the other hand, Guinea grass (*P. maximum*) and Para grass (*P. purpurascens*) appear useful for erosion control but have no recorded wildlife food value.

Paspalums

These grasses rank as a poor second to the panic grasses in their general usefulness to wildlife; 20 kinds are known to be eaten by 50 animals, most of which are birds. Bull paspalum (*Paspalum boscianum*) is eaten by 14 birds, notably the bobwhite, eastern

redwing, mallard, and pintail. A half-dozen other paspalums are important foods of the bobwhite, and the agronomically important Dallis grass (*P. dilatatum*) contributes to the sustenance of the bobwhite and lesser scaup duck. Vasey grass (*P. urvillei*), Bahia grass (*P. notatum*), and ribbed paspalum (*P. malacophyllum*), all of promise as forage and erosion-control plants, are not known to furnish food for wildlife.

Bluegrasses and Fescues

Like other pasture and range plants, bluegrasses aid in establishing a cover of vegetation that contributes immeasurably to the control of erosion. Although 50 kinds of wildlife are known to eat about half a dozen different kinds of bluegrasses, most of the records are nonspecific. Kentucky bluegrass (*Poa pratensis*), a valuable pasture plant, leads the list, with 8 animals known to eat it. Canada bluegrass (*P. canadensis*) is eaten by the muskrat and is of fair palatability to mule deer in California. Important range species include Sandberg bluegrass (*P. secunda*) of the Northwest, eaten by the mule deer; muttongrass (*P. fendleriana*), grazed by deer and elk as well as livestock; and Nevada bluegrass (*P. nevadensis*), of value to western big game. Although not so recorded, the highly nutritious bulblets of bulbous bluegrass (*P. bulbosa*) must be consumed by wildlife as they are by livestock.

Outstanding forage grasses are numbered among the fescues. A half-dozen kinds of wildlife eat six-weeks' fescue (*Festuca octoflora*), an annual of sterile soil throughout the United States, and as many animals utilize red fescue (*F. rubra*). Others are locally useful, such as meadow fescue (*F. elatior*), of value to mule deer in California; bluebunch fescue (*F. idahoensis*), eaten by mule deer and elk; sheep fescue (*F. ovina*), eaten by black duck and black-tailed deer; and Arizona fescue (*F. arizonica*), which is a valuable summer food for elk in Arizona.

Timothys and Bents

Timothy (*Phleum pratense*) is the foremost American hay grass, and its wildlife record is also good, for 20 kinds of birds are known to eat it. Alpine timothy (*P. alpinum*), of our western mountains, is consumed by mule deer, elk, and a few birds.

Very few of the bent grasses are used much by wildlife, although redtop (*Agrostis alba*), a standard pasture grass, is eaten by 4 animals, and unidentified members of the genus *Agrostis* provide food for 5 mammals and 15 birds, among which the ruffed grouse is conspicuous. Creeping bent (*A. palustris*) is

known to be eaten by the New England cottontail and California mule deer. Colonial bent (*A. tenuis*) from which New Zealand, Rhode Island, and other agronomically important bents have been derived, is without known wildlife use.

Bromes and Bluestems

Brome grasses occupy an important place in meadow and pasture management, and a dozen species are known to provide food for about 35 birds and 15 mammals. Smooth brome (*Bromus inermis*) is considered highly palatable to elk; rescue grass (*B. catharticus*) is a food of the Arizona scaled quail; and nodding brome (*B. anomalous*) is eaten by the mule deer. Even the weedy soft chess (*B. mollis*) is valuable as food for the California quail, valley quail, and mule deer, and downy chess or cheat grass (*B. tectorum*) provides food for a few birds, among them the plumed quail. There is no record of wildlife utilization of true chess (*B. secalinus*), a useful hay grass in some sections.

Big and little bluestems were dominant components of the tall grass prairies, and are still abundant in some places; although they furnish ample cover, their use by wildlife for food is negligible. Perhaps the most valuable member of the group is bushy beardgrass (*Andropogon glomeratus*) an important beaver food in Texas; it is also eaten by the bobwhite, opossum and woodchuck. The abundant broomsedge (*A. virginicus*) of old fields in the Southeast is eaten occasionally by the bobwhite and sparingly by several other birds.

Ryegrasses, Wild-ryes, and Wheatgrasses

Italian ryegrass (*Lolium multiflorum*) is an important food of the California quail; seeds of darnel (*L. temulentum*) are also eaten by this quail as well as by the valley quail and a few other birds. Perennial ryegrass (*L. perenne*), of use to the soil conservationist as a cover and pasture plant, is very palatable to deer. Common rye, believed to be a genetic and mechanical mixture of Italian and perennial ryegrasses, has no reported use.

Wild-ryes are significant in western conservation operations, and they furnish food for eight kinds of wildlife. Both blue wild-rye (*Elymus glaucus*) and giant wild-rye (*E. condensatus*) are useful as food for elk and mule deer, although Canada wild-rye (*E. canadensis*) has no recorded wildlife food value.

Five kinds of wheatgrass are eaten by 15 kinds of wildlife. Slender wheatgrass (*Agropyron pauciflorum*) and western wheatgrass (*A. smithii*), both highly nutritious and palatable to livestock on the western

range, are the species of most value. The troublesome quackgrass (*A. repens*) has a negligible record of use by wildlife, and crested wheatgrass (*A. cristatum*) from Asia, so popular for range reseeding, is without records of utilization for food by American animals.

Bristlegrasses and Crabgrasses

Ranking high as food for wildlife, although essentially weedy plants, are the bristlegrasses or foxtails; 6 species are known to be eaten by 100 birds and about 10 mammals. Yellow bristlegrass (*Setaria lutescens*) has an unexcelled record for a noncultivated grass; its seeds are eaten by 4 mammals and 62 birds, including the Hungarian partridge, ring-necked pheasant, and several ducks. Green bristlegrass (*S. viridis*) is likewise valuable, for it provides food for 7 mammals and 49 birds, among which are the greater prairie chicken, Hungarian partridge, and mourning dove. Both of these grasses are also important foods of the bobwhite in the Southeast. Knotroot bristlegrass (*S. geniculata*) is an important bobwhite food plant; and foxtail millet, also called German or Italian millet (*S. italica*), is eaten by about 15 animals.

Although a weed, true crabgrass (*Digitaria sanguinalis*) supplies provender to 36 animals and is a useful food of the bobwhite. Smooth crabgrass (*D. ischaemum*) is likewise valuable to the bobwhite, as well as to 15 other kinds of wildlife. Other species are also significant, the crabgrasses being known to provide food for a total of 50 birds and several mammals.

Needlegrasses and Dropseeds

Although conspicuous elements of much of the western range, the needlegrasses do not furnish much food for wildlife, even though 20 animals are recorded to eat them. The seeds of green needlegrass (*Stipa viridula*) and needle-and-thread (*S. comata*) contribute sustenance to three animals, while Richardson needlegrass (*S. richardsonii*) is eaten by the mule deer and porcupine grass (*S. spartea*) by the elk.

There are a few records of wildlife utilization of the Western sand dropseed (*Sporobolus cryptandrus*), and of alkali sacaton (*S. airoides*), although more wild animals are known to eat seeds of eastern species, as *S. vaginiflorus*, *S. asper*, and *S. neglectus*, each consumed by three or more birds.

Gramas and Buffalo Grass

Soil-conserving range grasses include few more important than the gramas. As a group they are used considerably by wildlife, 30 animals being known to

eat them, but important species of the genus, such as side-oats (*Bouteloua curtipendula*), Rothrock (*B. rothrockii*), and hairy (*B. hirsuta*) gramas, are apparently of little or no food value to wildlife, while black grama (*B. eriopoda*) is known to be eaten only by the prairie horned lark. Needle grama (*B. aristidoides*) and blue-grama (*B. gracilis*), however, are used by at least a half dozen animals each, blue grama being especially valuable to the Arizona scaled quail and Gambel quail.

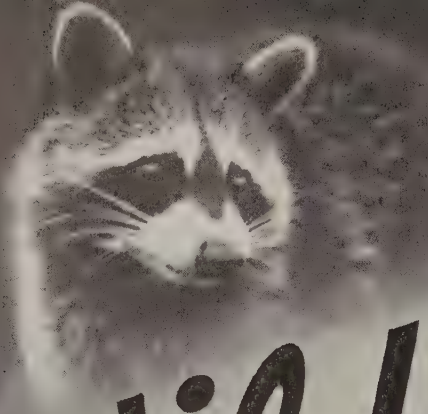
Buffalo grass (*Buchloé dactyloides*), an important component of short grass range, is eaten by four birds, including the scaled quail, and is a preferred food of the pronghorn.

Other Grasses

Bermuda grass (*Cynodon dactylon*) has become highly valued in the South and Southwest as an erosion-control plant in pastures, for lining terrace outlets and diversion ditches, and for stabilizing gullies. Its seeds are eaten by 10 birds, including the mallard, pintail, and green-winged teal. Wild oats (*Avena fatua*) protectively clothes many California valleys and foothills to the near exclusion of other herbaceous plants; it is a European introduction used for food by 30 birds and several mammals. Carpet grass (*Axonopus compressus*), long a useful pasture plant of the Gulf Coast, is eaten by the bobwhite and Brewer's black bird. Seeds of several cordgrasses are food for wildlife, although the conspicuous member of the genus, prairie cordgrass or sloughgrass (*Spartina pectinata*), has a negligible record of usefulness. Reed canary grass (*Phalaris arundinacea*) is eaten by ruffed grouse and green-winged teal, and orchard grass (*Dactylis glomerata*) by several animals. Seeds of the introduced Egyptain grass (*Dactyloctenium aegyptium*) are consumed by 8 birds, including the bobwhite, and are considered an important food of the mourning dove in the Southeast.

The genus *Hilaria* includes several grasses useful to the range manager, such as curly mesquite, galleta and tobosa, but records of wildlife use are few. Another useful range plant is June grass (*Koeleria cristata*), eaten by the mallard, mule deer, black-tailed deer, and elk. Indian ricegrass (*Oryzopsis hymenoides*) is one of the best desert range species; it, along with a few other species of the genus, furnishes food for 8 birds and a half-dozen mammals. Foxtail barley (*Hordeum jubatum*), a conspicuous weed of the West, is eaten by several birds and a few mammals, as muskrat, deer, elk, and antelope, but the barbed awns cause injury and infection to the mouths of grazing animals and make it a serious pest of livestock and big game.

(Continued on p. 250)

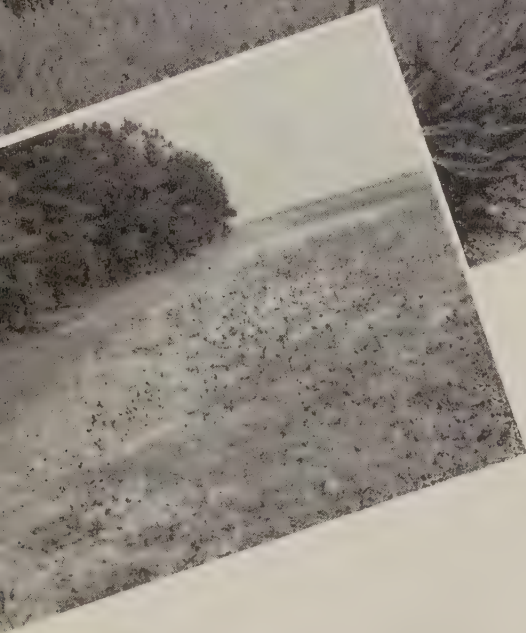


Wildlife Land

On all American farms are lands that are wholly unsuited for cultivated crops, hay, pasture, or woodland. These lands include such places as field borders, odd infertile spots, streambanks, severely eroded areas, ditchbanks, and marshland—



Field borders

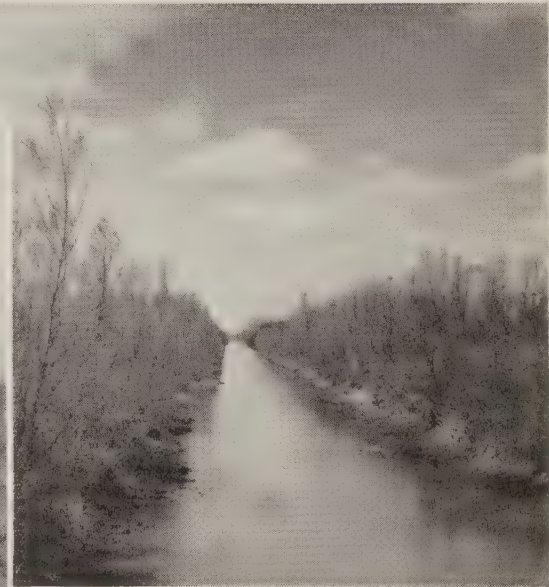


Odd infertile spots

Severely eroded areas



Streambanks



Ditchbanks

Marshlands

—All told, 33 million acres of American farmland are suitable only for the production of wildlife. Efforts to make them productive of something else are largely wasted. Used for wildlife they benefit agriculture.



(Continued from p. 247)

A plant valuable to wildlife, although weedy, is the common barnyard grass (*Echinochloa crusgalli*), known to be eaten by more than 50 animals. It is especially important to waterfowl and upland game birds. Japanese millet, advertised as a wildlife food plant, is a variety of barnyard grass. The three-awns are common grasses in some parts, but only 3 species furnish food for wildlife; the most used is arrow feather (*Aristida purpurascens*), seeds of which are eaten by the bob-white, scaled and Gambel quails. Even the spiny-fruited sandburs provide food for a half dozen animals. That rodents may be beneficial by virtue of their food habits is shown by the fact that the cheek-pouches of a spotted ground squirrel were found filled with the seeds of the troublesome dune sandbur (*Cenchrus tribuloides*).

Dune grasses, on the whole, are little used by wildlife for food, but grasses of moist places are utilized to an exceptional extent. As food for wild ducks, the wildrice (*Zizania aquatica*) of lake and pond margins is probably the outstanding grass, for it is eaten by 30 birds, including blue-winged and green-winged teals, lesser and great scaup ducks, canvasback, ring-necked duck, redhead, mallard, black duck, baldpate, wood-duck, and pintail. The closely related Southern wildrice (*Zizaniopsis miliacea*), although used by several birds, spreads on shallow silt flats to such an extent that it presents a weed problem. Rice cutgrass (*Leersia oryzoides*) is another wet-land plant eaten by 15 birds, and saltgrass (*Distichlis spicata*) of alkali meadows is of value as food for 31 birds, many of which are waterfowl. The widespread bluejoint (*Calamagrostis canadensis*) of moist areas is palatable to mule deer and elk and much eaten by muskrat in Ohio; its seeds are relished by a few birds. Mannagrass (*Glyceria striata*) should also be listed with the good wildfowl foods. The common reed (*Phragmites communis*), so abundant in wet places throughout the country, is a staple food of muskrat in Louisiana.

A few well-known grasses, conspicuous because of their size, that have no recorded wildlife food value are sugar cane (*Saccharum officinarum*); giant reed (*Arundo donax*); southern cane (*Arundinaria gigantea*) of the southeastern canebrakes; its lesser relative small cane (*A. tecta*); and the ornamental South American pampas grass (*Cortaderia selloana*), being used experimentally as an erosion-control plant. The fact that seeds appearing to be useful to wildlife may not necessarily have such value is illustrated by the large white seeds of Job's tears (*Coix lacryma-jobi*), which are not known to be eaten by any animal. A number

of other grasses, many recently introduced for trial as erosion-control plants, have as yet no known wildlife usefulness. Perhaps we shall learn of their value to wildlife as we are learning of their contribution to erosion-control. Among them are Asiatic centipede grass (*Eremochloa ophiuroides*), a lawn and pasture plant for the South; Rhodes grass (*Chloris gayana*) an African introduction for southern Great Plains pasture; Kikuyu grass (*Pennisetum clandestinum*), of use on water disposal systems in California; and lovegrass (*Eragrostis curvula*).

Twenty-four Grasses Most Used by Wildlife for Food

[Compiled from records of the Fish and Wildlife Service]

Common name	Scientific name	Birds	Mammals	Total
Corn	<i>Zea mays</i>	127	19	146
Wheat	<i>Triticum aestivum</i> *	110	10	120
Oats	<i>Avena sativa</i> *	96	13	109
Yellow bristlegrass	<i>Setaria lutescens</i> *	62	4	66
Barley	<i>Hordeum vulgare</i> *	58	6	64
Green bristlegrass	<i>Setaria viridis</i> *	49	7	56
Barnyard grass	<i>Echinochloa crusgalli</i>	50	4	54
Rice	<i>Oryza sativa</i> *	40	...	40
Wild oats	<i>Avena fatua</i> *	34	2	36
Crabgrass	<i>Digitaria sanguinalis</i> *	34	2	36
Witchgrass	<i>Panicum capillare</i>	34	1	35
Seashore saltgrass	<i>Distichlis spicata</i>	31	...	31
Sorghum	<i>Sorghum vulgare</i> *	30	2	32
Annual wildrice	<i>Zizania aquatica</i>	30	...	30
Smooth crabgrass	<i>Digitaria ischaemum</i> *	15	1	16
Rye	<i>Secale cereale</i> *	15	1	16
Rice cutgrass	<i>Leersia oryzoides</i>	14	1	15
Italian millet	<i>Setaria italica</i> *	14	1	15
Southern wildrice	<i>Zizaniopsis milicea</i>	14	...	14
Bull paspalum	<i>Paspalum boscianum</i>	14	...	14
Fall panicum	<i>Panicum dichotomi- florum</i>	13	...	13
Johnson grass	<i>Sorghum halepense</i> *	11	...	11
Bermuda grass	<i>Cynodon dactylon</i> *	10	...	10
Slender crabgrass	<i>Digitaria filiformis</i>	9	...	9

*Introduced species.

Bees, Legumes, and Conservation

By extending the acreage of legumes used by bees, programs of soil conservation and agricultural adjustment aid beekeepers. Conversely, beekeepers contribute to such agricultural programs—the 1942 goal for seed production of leguminous crops, set at 415,000 acres, will be realized in no small part because of pollination by honey bees.

ADOLPH LEE LOOKED AHEAD

By WALLACE L. ANDERSON¹

A simple story of the benefits to wildlife on a Wisconsin farm where soil-conservation methods are in use.

ADOLPH LEE might be called a "rugged individualist." Twenty years ago he did something nobody else in his neighborhood had ever done—he planted willows along the meandering stream that cuts diagonally across his steeply rolling farm of 144 acres in Vernon County, Wis. In 1941 Adolph Lee was cropping areas that 10 years before were part of the stream, while on neighboring farms the same stream was still barren of cover and still cutting its banks.

Back in 1934 Adolph had "joined the erosion"—cooperated with the Soil Erosion Service—and in 1940 he "joined up" with the Coon Creek Soil Conservation District, now the Vernon County Soil Conservation District. His farm plan included maintenance of his protected stream, protection of steep woodlands from fire and grazing, pasture improvement, and contour strip cropping with rotations having a high percentage of alfalfa.

Comparison of information obtained by Soil Conservation Service technicians in 1940 with that obtained by a previous survey in 1935 indicates that 5 years of conservation farming have had a significant influence on the wildlife of Adolph Lee's farm. There was an 11-percent increase in the number of nesting birds and a 20-percent increase in the number of species of birds living on the farm. The presence of woodcock in

1940 in one of the formerly pastured woodlands indicates how 5 years of protection had transformed this area from one of hard, dry soil compacted by the hoofs of cattle to one of moist, mellow soil protected by forest litter and porous enough to let a "timber-doodle" probe for his favorite earthworms.

The 1935 survey showed but one brood of ruffed grouse, no bobwhite quail, and no ring-necked pheasants. In 1940 there were two broods of grouse, four of quail, and two of ring-necked pheasants. The surveys confirmed the fact that willows are not the best nesting cover for birds along streams. Boxelder, with its denser growth, contained three times as many nests as willows even though the latter were more abundant. Forty-three percent of all the birds nesting on the farm were found along the narrow stream and in fence rows, which together occupy less than 4 percent of the total farm area. Another 32 percent of the nesting birds were found in woodlands and orchard. The remainder were in cropland, pasture, and the farm yard.

Adolph Lee is an enthusiastic sportsman who appreciates game birds and animals, but as a farmer, he says: "I need song birds too, for they help me grow better crops by keeping insects in check. I'd rather have my streambanks doing a good job of controlling erosion and producing birds than a poor job of supplying pasture. I hope we can have still more birds on the farm."

¹ Assistant chief, regional biology division, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

SOIL CONSERVATION FAVORS BOBWHITE

By VERNE E. DAVISON¹

Land-use practices designed to conserve soil and moisture provide food for the bobwhite, as revealed by studies in the Southeast. An increased supply of quail—most valued game bird of the South—is shown to be closely correlated with soil and water conservation operations.

ON THE general run of farms in the Southeast the provision of adequate food and its interspersion with cover are the most important contributions to the establishment of desirable habitat for the bobwhite quail. A study of the crops of 5,889 bobwhites taken in the Southeastern States shows that a soil-conserva-

tion program provides the foods essential to the survival and increase of this bird. With erosion-control practices creating new patterns of permanent land use it can be expected that the bobwhite population will increase.

The study revealed that seeds of common and Korean lespedezas are eaten more generally than those of any other plants. Similarly, Kobe lespedeza, cowpeas, soy-

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beans, partridge-peas, Florida beggarweed, and peanuts are dependable foods where they can be supplied in sufficient quantity. Only one is needed—not all of them. With the exception of partridge-peas and Florida beggarweed, these are field crops useful in crop rotations. Strip cropping with these legumes furnishes an abundance of seed every year. Without strip cropping, food may be abundant one year and absent the next.

Acorns rival the annual lespedezas as food for the bobwhite and they are supplied in sufficient quantity in most ungrazed woodlands. The seeds of sweetgum, the fruits of flowering dogwood and blackgum, and occasionally pine mast also are important woodland foods. Plants that are principally valuable for shelter but are frequently taken for food include Japanese honeysuckle, sumac, black cherry, poison-ivy, sparkleberry, and grape. These plants are naturally abundant in woodland borders, hedges, and small shrub areas.

Several annual and perennial herbs, although relatively unimportant on the average farm, also supply food in varying amounts. They flourish on burned or idle areas. The more important are perennial beggar-

weeds, partridge-peas, milkpeas, tickclovers, wild beans, groundnut, and butterfly-pea.

Wild vetches are important in spring and early summer, and *Lespedeza sericea* may prove to be particularly valuable when snow covers other food plants. *Sericea lespedeza* is becoming recognized as the most dependable plant for field borders where it serves primarily as a shelter for both soil and wildlife. Waste grains of corn, wheat, and sorghums, together with the ragweeds, bull grass, insects, and greens of the field complete the important items of diet for the bobwhite on the average farm.

A soil-conservation plan including uncut *sericea* field borders, shrubby woodland borders, protected stream banks, hedges, and small shrub areas, should improve and assure adequate food for bobwhites on farms that have strip-crop rotations, woodland management (including controlled burning when desired and protection from grazing), improved pastures, protected crop residues, and perennial hay supplies. Thus, a soil-conservation plan favors the proper distribution of shelter among those foods known to be particularly useful to the bobwhite quail, and so may contribute materially to the increase of this desirable bird.

TEN YEARS OF PROTECTION

By CHARLES A. DAMBACH¹

A cardinal principle of soil conservation is the protection of woodlands from destructive fire and grazing. In an Ohio farm woods this resulted in an increased volume of timber, greater yields of maple sugar, a mellowing and enriching of the soil, and excellent reproduction of valuable trees. Significantly, the insect-destroying birds were found to be four times as numerous as in adjacent mistreated woodlands.

IN APRIL 1931, 2 men working 3 days used 180 rods of salvaged barbed wire, 59 posts cut from disease-killed chestnut trees, and 2 pounds of staples to build a fence along the pasture side of the Kibler woods in New England-like Geauga County, Ohio. The ensuing 10 years' relief from trampling hoofs and munching jaws worked wonders on the 7.9 acres of maple grove protected by the new fence. It is easy to see what protection has done for this woods. Adjoining it and separated from it only by a fence, is a similar maple grove; similar, that is, in that it is on a comparable site, and has the same proportion and size of tree species; but dissimilar in that continued grazing has brought about many changes.

The most obvious difference between these woods is the abundance of natural tree reproduction on the protected side and the near absence of reproduction on the grazed side of the fence. Sample plots indicated that in 1941 there were approximately 53,000 young trees per acre, ranging in height from 6 inches to 21 feet, in the protected lot; whereas there were fewer than 1,000 seedlings per acre, 5 inches or less in height, in the grazed tract. Of the young trees 98 percent are sugar maples, the preferred tree in this maple sirup-producing section. Many tulip poplar, white ash, cucumber magnolia, red and white oak, and wild black cherry are also present. Because he knows his woods intimately, F. E. Kibler is able to point proudly, in the protected woods which he owns, to individual trees that he has watched grow from tiny seedlings

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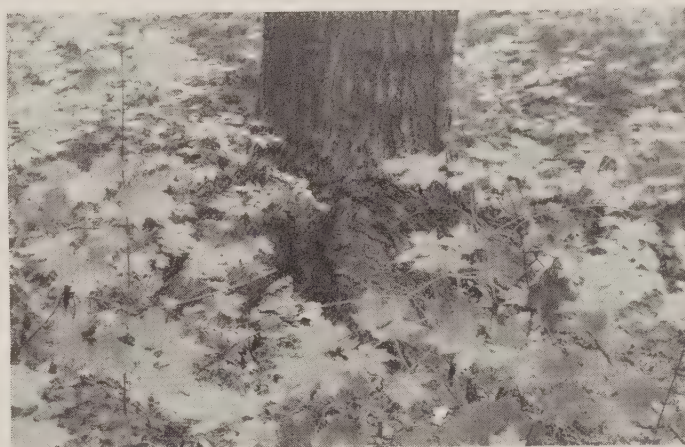
to a height of 18 to 21 feet within 8 to 10 years.

To one accustomed to visiting each mature maple many times a year, to tap, hang buckets, and gather sap, another difference in the woods is evident. The soil, which 10 years ago was hard packed around the base of each tree, exposing the shallow roots, is becoming mellow and soft. The roots are nearly all covered with a thick layer of leaves that once were scattered by the wind and blown into the draws where they did little good. This observation is supported by checks of soil compaction and litter depth in both woods. A study of frost penetration records adds further proof: Measurements made on February 14, 1941, after an extended cold snap with a low of -16° F. showed that in the grazed woods frost had penetrated 2 to 6 inches. In the protected woods the soil was loose and moist beneath the protective mantle of leaves. The difference was not entirely due to the leaves, however, as the protected woods was covered with a uniform blanket of snow 8 to 12 inches deep. Across the fence, the snow was deep only at the east end, where it had been blown by the wind.

An early morning visit to these woods late in May, when birds are particularly evident by their singing, would demonstrate the effect of woods protection upon wildlife populations. The songs of birds would be noticed to come much more frequently and in greater variety from the protected woods than from the grazed tract which is twice its size. A census of nesting birds, conducted through 4 seasons, showed that in the protected woods there were 19 species of song birds and a yearly average of 1.7 pairs per acre.



A close view accentuates the contrast between the woodlot with ten years' protection and the woods that is still grazed across the fence.



In the grazed woods there were only 8 species and 0.4 pair per acre per year. In other words, the protected woods were being policed by 4 times as many insect-eating birds as benefited the grazed woods.

(Continued on p. 254)

DOES KUDZU HAVE WILDLIFE VALUE?

By VERNE E. DAVISON ¹

KUDZU, first used as a porch vine in the Southeast, has become a stalwart ally in the control of erosion in gullies and on severely eroded slopes. In the Southeast, during the past few years, thousands of acres have been planted with kudzu for soil-conservation purposes. The value of this plant for hay and grazing is becoming apparent, and its permanence in southern agriculture seems assured by its successful use for soil improvement in crop rotations.

Little is known concerning the value of kudzu for farm wildlife. Rabbits use it, eating the leaves during the growing season and the bark in the winter. In fact, more than once has a concentration of rabbits been known to destroy in a few weeks small areas of

newly planted kudzu adjacent to good rabbit habitat. T. W. Edwards, of Wilkesboro, N. C., "used kudzu as the sole roughage for about a dozen tame rabbits during one summer and found it to be very satisfactory either green or cured. The rabbits seemed fond of it and thrived on it."

Kudzu is of unquestionable value to wildlife in an indirect way. Removal for hay of annual soil improvement crops—lespedeza, cowpeas, and soybeans—will be unnecessary when hay needs are supplied by perennials such as kudzu. Thus wildlife foods will be left with the plant material that should be returned to the soil for the benefit of succeeding crops. Kudzu will influence farm wildlife—this is unquestionable—but just how and to what extent is now being determined.

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PROVIDING FOR WILDLIFE IN FARM PLANNING

By HOMER G. TOWNS¹ and HARVEY D. BURKHALTER²

To devote every parcel of land to its best and safest use is the goal of farm planning. An example from Louisiana demonstrates the method and discusses the results.

THE farm of J. A. Burgess at Bernice, La., is a typical farm operated by a typical farmer. Its planning and development illustrate the basic principles of correct land use. Mr. Burgess signed an agreement with the D'Arbonne Soil Conservation District on May 29, 1939; in December 1941, practically all obligations set forth in the agreement had been completed.

Before the agreement, there were on the farm approximately 62 acres of cultivated land, no meadow, 21 acres of native brushy pasture, 14 acres of woods pasture, and 11.5 acres of woods protected from grazing. Livestock consisted of 3 to 5 cows and calves, 1 to 5 hogs, and 3 mules. Winter feed produced was insufficient; all crop residues were consumed, and the pastures were in a much over-used condition. Because of grazing and burning and because there had been no selective cutting, the woods had been yielding only firewood and posts for home use, in spite of the fact that, with protection and proper cutting practices, they could provide all the wood products needed on the farm and in addition an estimated increment of \$75 to \$100 per year. At the time the farm was planned, so far as Mr. Burgess knew—and he knew his land well—there had never been more than 2 coveys of bobwhite quail on it at any one time.

In planning the farm, very little change was made in the general scheme of land use. The amount of land devoted to cash crops and to permanent pasture remained essentially the same. Three and one-half acres of meadow were added, and 20 acres of woods were protected from grazing. One and one-half acres of gullied, brushy, and rocky land were devoted to wildlife, and borders of sericea lespedeza were established between woods and cropland. The plan also called for construction of a one-half acre farm pond that will provide water for livestock and, if properly managed, all the fish the family can use. A system of crop rotation was established to include both summer and winter legumes; and 5 acres of steep, badly eroded cultivated land (class VII) were converted to pasture and woodlot. Pasture improvement practices in-

cluded mowing, sodding, seeding, fertilizing, and contour ridging.

By 1941 Mr. Burgess was of the opinion that his per-acre crop yields had increased approximately 25 percent and that the carrying capacity of his pasture had more than doubled; he also produced 7 to 8 tons of hay whereas formerly he had produced none. Seventeen animal units of livestock are now supported, with sufficient pasture and supplemental feed for winter use. There are now 5 coveys of bobwhite quail on the farm. It is evident that these quail, as well as the small birds and mammals that are on the farm throughout the year, owe their existence in part to the fact that proper treatment of each parcel of land on the farm increases what is known by the biologists as "habitable edge," thus making every acre of land on the farm contribute its share to the welfare of wildlife. On the Burgess farm this habitable edge was increased from approximately 100 to 600 rods.

The average farmer does not need to reduce the production of cash crops to provide for wildlife; frequently he can provide habitable edges as a natural result of farm operations conducted in accordance with a sound soil and moisture conservation program. The job for the farm planner is to visualize, as did the farm planner for the Burgess farm, the opportunities that exist for using every parcel of land in accordance with its needs and capabilities.

TEN YEARS OF PROTECTION

(Continued from p. 253)

The comparative abundance of woodland shrubs and wild flowers is no less striking than that of birds and seedling trees. Red elder, blackberry, raspberry, sassafras, and thornapple, which provide food and nesting cover along the margins of the protected woods, are absent or sparse across the fence. Also present in the protected woods, are such wild flowers as the large flowered trillium, Sweet William, bloodroot, spring beauty, Jack-in-the-pulpit, and hepatica. More delicate plants, as ground-nut, Dutchman's breeches, and large roundleaf orchid, are again making an appearance. Even the much-collected ginseng that

(Continued on p. 256)

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WILDLIFE INCREASED BY EROSION CONTROL PRACTICES

By A. C. HAWBECKER¹ and R. M. BOND²

Substantial increases in wildlife have been observed repeatedly on farms where soil conservation measures have been put into effect. A painstaking count in California confirms the close relation between patterns of land use and wildlife numbers.



Basin-listed and planted in 1937, this field by 1941 supported a thrifty stand of young knobcone and Monterey pines.



Young mourning doves on their nest in one of the Monterey pines of the 4-year-old erosion-control planting shown in the other view.

WHAT happened on the Morse Ives farm, near Watsonville in Santa Cruz County, Calif., lends force to the statement that soil and wildlife conservation are interdependent, and that planting appropriate vegetation on eroded or otherwise unproductive lands will increase wildlife. In 1932, Mr. Ives observed that rapidly declining yield was rendering an upper

field of 120 acres unprofitable for crop, and that soil washing from it was injuring a valuable lower field. Intensive cultivation had produced severe sheet erosion, the productivity of the farm was low, and the numbers and species of wildlife on it were few. That year he planted a few rows of trees, mostly Monterey pines, on the eroding field. In January 1937, after this planting had reached an appreciable size, the remainder of the 120 acres was basin listed and planted with trees and shrubs in cooperation with

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the Soil Conservation Service. This treatment was primarily to provide the eroding land with a cover of vegetation, but open spaces in the plantation, the species of plants, and their arrangement were planned to benefit wildlife, particularly quail. Survival was about 50 percent, and at the end of the third growing season there remained alive approximately 25,000 trees and shrubs. The important surviving species were Monterey and knobcone pines, Arizona cypress, mahogany sumac, laurel sumac, and ceanothus.

In March 1937, 2 months after the second planting, the California Division of Fish and Game released 7 quail on the farm. Some of the birds survived and bred, although food was exceedingly scarce and the only permanent cover was afforded by the few trees planted in 1932. The growth of annual seed-producing herbs and grasses, however, was better than in previous seasons, probably because of the basin listing. By the autumn of 1937 there was a covey of about 15 quail on the farm, most of which survived the winter. In May 1938 several mated pairs were observed and later young were seen. A census in the autumn of 1938 showed a population of approximately 40 birds. A year later, October 1939, 47 quail were counted—a small relative increase due probably to the low rainfall of the preceding winter, which adversely affected plant growth and may have curtailed the food supply.

In 1940 the Ives farm became Camp McQuaide, and roads and buildings were constructed in the plantings. Conditions were so radically altered that intensive study of the wildlife was discontinued. However, observations made in the spring and summer of 1940 showed that there had been an excellent quail hatch, and that autumn there were probably 80 to 100 quail on the area. Quail were also abundant in 1941, and 2 broods of newly hatched young were found in June. So far as known, all the quail were descendants of the original 7. There was some hunting in 1938 and 1939. Ground squirrels were reduced occasionally by gassing, but there was no predator control.

Because small birds in this part of California nest from early February to August, a complete census of breeding birds is impractical; but in late May and early June of 1940, Charles G. Sibley, a student assistant in biology, made a nesting census in 53 of the 120 acres planted. He found 62 nests of 8 species. Thirty-five nests were in trees—27 of the trees were Monterey pines. By 1941, the shrubs were also in use; a cursory survey in June showed many nests of willow goldfinches and several of Nuttall sparrows in the ceanothus.

That conditions favorable to one kind of wildlife usually are favorable to many is demonstrated by a comparison of the birds found on the Ives farm with those found on adjacent land in an eroded and barren condition. Twenty-six species of birds, 14 of which nested, were seen on the farm in 1940 and 1941. On the adjacent check area there were only 18 species of birds, 7 of which nested. As examples of changes that have occurred, pheasants, although rare outside became abundant on the planted area, whereas horned larks became less common because of the dense ground cover.

The importance of water to bird life even in this relatively humid part of California was demonstrated when the cooperator, in the spring of 1940, constructed a watering station at ground level in the midst of a planting of ceanothus when the shrubs were about 4 feet high and afforded fair cover. By midsummer the ground around the basin was littered with molted feathers, and pheasants and quail were making constant use of the shrubs as dusting and loafing cover. Several counts for short periods were made of the birds coming to this water. On June 7, 1940, observation was maintained from 9 a. m. to noon, and from 1:30 to 4 p. m. During these periods 358 birds of 11 species used the water for drinking or bathing. The most numerous were the house finch, 239 of them; the Lawrence goldfinch, 45 in number; and 19 Nuttall sparrows. A few weeks later, when the vegetation had become drier, many quail, pheasants, and meadow larks also came to the water. A band-tailed pigeon used the water all summer. This water supply is now maintained by the Army, and the birds still use it eagerly.

TEN YEARS OF PROTECTION

(Continued from p. 254)

has long brought fancy prices on the drug market, has become established in several colonies in the last few years. Continued grazing has excluded or dwarfed these and other woodland plants across the fence.

Mr. Kibler is convinced that protection has increased the yield of maple sirup and the volume growth of timber; that it has stopped loss of trees from grazing injury; ensured reproduction of new trees to replace those removed; and that it has made the woods a more interesting place because animal as well as plant life is more abundant. Above these values, he realizes a glow of pride in having made a worth-while contribution to conservation in his community. He is the first cooperator in the Northeast Ohio Farm Forestry Area, and his farm and his woods are serving as a demonstration of wise management. The comparison with the grazed woods will not last long though, for his neighbor plans a fence, too.

WILDLIFE MANAGEMENT ON IRRIGATED FARMS

By H. P. PRATT¹ and W. S. LONG²

Farmers who must pay a high price for irrigated land obviously cannot afford to use it wastefully. Yet spoil banks along hundreds of miles of irrigation ditches are usually productive of little more than a crop of weeds. By proper treatment, however, these noxious plants can be largely eliminated, the banks stabilized, and in the same operation the relatively abundant wildlife of irrigated farmland can be profitably increased.

IN MANY parts of the United States homes for wildlife have been destroyed by draining of swamps, plowing of grasslands, cutting of forests, and by clean cultivation, but on irrigated lands of the West agricultural operations have often converted barren areas into suitable habitats for pheasants, quail, ducks, and other forms of wildlife. Such operations provide water—a critical factor in the survival of both man and wildlife in arid and semiarid regions. Excellent pheasant hunting exists in the irrigated sections of northern Colorado, central Utah, and southern Idaho, whereas ring-necks are almost nonexistent outside watered areas. The irrigated hay meadows of the Gunnison and San Luis Valleys, Colo., now are nesting grounds for many ducks. In early days, according to the people who first settled these valleys, only a few ducks nested along the streams, but after water was spread over the valley lands the ducks began to increase.

Most irrigated lands offer wildlife the essentials of food, cover, and water. Crop residues and waste grain that remain on the fields during the colder months provide winter food in abundance. Ditches furnish water during the summer season when it is most needed, and the banks, which usually are grown up with cover of various kinds, provide travel lanes to food, cover, and water. With conditions so nearly ideal, it might be thought that wildlife management is not needed on irrigated lands. Unfortunately this is not true, because in many localities land use practices impede soil and moisture conservation and are detrimental to crop production and to wildlife.

When man and his agriculture came to the West, many weed and insect pests that had plagued him in the East came with him. Irrigation ditches were ideal places for noxious weeds. In the campaign against weeds, burning became one of the common methods of control. Burning, however, destroys wildlife cover, hinders the establishment of perennial grasses and

does not eliminate weeds. Occasionally, it destroys property and crops. On the other hand, the establishment of perennial vegetation along ditch banks replaces weeds, aids bank stabilization, and improves wildlife habitat. Desirable grasses and other plants, once established, should be protected permanently against burning and overgrazing. Some weed control may be necessary until the grasses are well established. Where conditions are suitable, dense, low-growing shrubs, such as sumac, rose, wild plum, and blackberry may be substituted for grasses. A low-growing tree of high wildlife value that may be so used is the Russian olive. Spoil banks along drainage ditches and waste areas between ditches and fences are best suited for woody plantings since care must be taken to prevent establishment of shrubs where they may spread into cultivated fields or interfere with ditch maintenance. A few fruit trees and berry bushes may be planted with the shrubs to provide an addition to the farm diet or to augment the farmer's cash income.

Another destructive practice in irrigated areas is the overgrazing of fields in winter. Horses and cattle often are turned into fields to graze on crop residue and are kept there most of the winter. Under such conditions, cover in odd corners and along the fence rows and ditches may be completely destroyed or so reduced that wildlife has little protection from predators and inclement weather. Likewise, serious damage to fields and crops may be caused through soil compaction; and the reduction of perennial grasses and shrubs increases noxious weeds and erosion hazards. Controlled grazing, on the other hand, does little harm and properly utilizes crop residues.

Where stock must be held on farm lands throughout the winter, planting of roses and other shrubs resistant to grazing, and fencing of key areas will improve conditions for wildlife. In many cases these areas also may be used as fruit and berry patches. The wildlife value of fenced areas is shown by winter counts of Gambel quail and ring-necked pheasants in two such areas near Grand Junction, Colo. Both were on

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irrigated farms where there was heavy winter use by livestock. In the first area there was an increase from 14 quail before fencing to 25 quail and 1 pheasant 8 months after fencing. In the second, which included a portion of a large wash, there were 24 quail and 1 pheasant 4 months before fencing, and 38 quail and 3 pheasants 8 months after fencing. Undoubtedly the increases were due to the favorable cover conditions resulting from the protection the fences afforded.

In most irrigated sections there are bodies of impounded water ranging in size from tiny ponds to large reservoirs. Siltation, grazing, complete drainage, and improper stocking with fish are among factors that prevent them from having a high wildlife value. Fenced areas at the upper ends of ponds aid in the

establishment of grass and shrubs and thus prevent silt from entering the basin. Such protected spots are extensively used by birds and mammals. The fencing of ponds and elimination of shore-line grazing by livestock also allows a permanent cover of protective vegetation to develop on the banks and shore, decreases siltation, and provides a good wildlife habitat. With proper management, the pond itself can produce fish—an additional source of food and income for the farm family.

Thus irrigated farms, already contributing much to the welfare of western wildlife, can be made of even greater usefulness by simple practices beneficial to agriculture and contributing to sound land management.

WATER FOR WILDLIFE IN THE SOUTHWEST

By A. E. BORELL¹

In the Southwest, good distribution of water means not only better livestock but also more wildlife. The country can use more of both crops.

THE problem of increasing wildlife populations in the Southwest often centers upon the supply of water. Food and cover are insufficient in many places; but on the other hand it is true that there are thousands of acres of potential wildlife habitats that cannot be fully utilized because of the absence of water. It is probable that by doubling the number of permanent watering places in arid areas the wildlife population could be doubled. Nor would this be an expensive undertaking, because in many instances it would mean no more than a modification of water developments made for other purposes.

The common set-up for livestock water—and there are thousands of them in the Southwest—is a windmill, a large circular metal storage tank, and a metal or concrete watering trough. Water in the tank and trough stands at 3 or more inches below the rim and is controlled by a drain that carries away the surplus water, often into a gravel bed. As a result, water is not safely available to wildlife and becomes a death trap to those animals that try to use it. Many birds and mammals are needlessly destroyed and their carcasses pollute the water. Occasionally, the tanks are covered and this prevents even the insect-destroying bats from getting water.

Any one of several simple inexpensive modifications of tanks and troughs will make water available to wildlife and prevent pollution. With tanks the sim-

plest procedure is merely to throw a plank into the water, but this is only temporary because sooner or later someone will remove the plank. The most satisfactory device is a heavy wooden float that is securely anchored by a plank hinged to it and to the rim of the tank. Hinging permits the float to ride the water level with its rise and fall. In lieu of a float, heavy hog wire of small mesh may be welded to the bottom and rim of the tank to provide a gently sloping ramp. If the wire is painted with tar or asphalt, the action of rust will be retarded. Concrete troughs should have steps built into one end. These steps permit birds to obtain water regardless of its level, and also aid the escape of livestock that accidentally get into the trough. Metal troughs may be provided with a wooden float or a wire ramp.

These devices make water available and safe to bats and adult birds, but young birds and nonflying mammals are not benefited. To make water accessible to all forms of wildlife and especially to young quail, it is necessary to construct a small basin that is almost flush with the surface of the ground. Such a basin should draw water from the storage tank and may be controlled by a float or drip pipe. It should be protected from livestock by a fence that will permit establishment of cover plants.

The water in earthen stock ponds is much used by wildlife, but if such ponds are unfenced, livestock may so concentrate as to keep the shores barren of vegetation. At such sites food and cover are not close at

(Continued on p. 262)

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WINDBREAKS AND THEIR VALUE TO WILDLIFE

By ADRIAN C. FOX ¹

In a broad belt from the Canadian border to central Texas, windbreaks have been set against the strong winds of the Great Plains. In a virtually treeless land these rows of trees and shrubs shelter man and his livestock, check the drifting soil, and provide a haven for wildlife.



Three years' growth of a newly established Wyoming windbreak, planted on the contour, has produced a thick, vigorous stand of trees bordered by fruit-producing shrubs. Here wildlife finds both food and shelter.

LIKE many other States of the Northern Great Plains, North Dakota was originally a sweeping expanse of undulating grass-covered prairie. Trees were confined to the fringes of small lakes and slow-moving streams. Early settlers plowed the grassy plains and cut the sparse woods, and at first wildlife profited—the prairie chicken thrived on waste grains in the cultivated fields that dotted the plains where nesting cover was still preserved. Then came intensified farming and increased livestock, and the prairie chicken found nesting sites and booming grounds confined to weedy fence rows and plowed fields. Other wildlife also felt the effect of the changes in land use.

Homesteaders brought to the Plains from the Eastern States or the countries of northern Europe an inborn love of their tree-covered homelands. This love of trees, together with the desire to obtain protection from hot summer winds and winter blizzards, induced the pioneers to plant windbreaks. Private initiative was stimulated by Government aid through the Timber Culture Act of 1873.

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Recent agricultural programs recommend trees for appropriate sites because they reduce wind velocity and wind erosion. Windbreaks make farm homes more habitable and protect feedlots and livestock from cold winter winds. Shrub buffers, gully, riverbank, and lake-shore plantings supplement the windbreaks. Recently snow-hedge plantings have been established along farm lanes and roads leading to rural schools, churches, and mail boxes in order to protect the roads from drifting snow. The snow hedges, together with other types of tree plantings, serve as wildlife havens.

Pheasants and Hungarian partridges range over the entire farm during the spring, summer, and fall months when they use field borders, fence rows, and the edges of shrub and grass buffers as travel lanes. When the snow deepens and the weather becomes more severe, the birds resort to the leeward sides of windbreaks and other sheltered areas where food and cover more nearly fulfill their needs. Thus, in designing and planting windbreaks, an effort is being made to compensate for wildlife habitat deficiencies.

Frequently the survival of a wild bird depends upon the amount and availability of winter food, just as the

amount of forage on pastures and ranges during any critical period determines the carrying capacity for livestock. With some species, however, as with the ring-necked pheasant, shelter requirements may be so closely associated with food requirements that without shelter even well-fed birds often perish from cold and suffocation. As windbreaks near maturity, the dense foliage of conifers, brush piles, undergrowth, and hollow trees provide a year-round shelter for many birds, as bluebirds, sparrows, woodpeckers, owls, hawks, waxwings, and chickadees. Raccoons, woodchucks, skunks, squirrels, and foxes likewise utilize this shelter and under proper management can contribute to the sport of hunting and trapping and to the economic welfare of the farm.

Wildlife foods such as fruits, berries, tree seeds, mast, and buds are furnished by many species of woody plants used in windbreak plantings. The native wolfberry, often used in fence rows and in the underplanting of taller trees provides berries which are available from August to late spring. They are a favorite winter food of pheasants, prairie chicken, and sharp-tailed grouse. Grape and Virginia creeper planted in fence rows on the leeward side of windbreaks provide food and excellent nesting cover where, during hot, late summer days, game birds seek shady

dusting spots. The fruit of Virginia creeper, available until late winter, is sought by ruffed grouse, prairie chicken, and many songbirds. The Russian olive, an introduced exotic, much used in many types of tree plantings, offers fruit which often persists until late spring, and is eaten by Bohemian and cedar waxwings, pheasants, and native grouse.

Dogwood, gooseberry, currant, rose and other shade-tolerant, native species used in under-planting windbreaks provide an understory which makes excellent nesting cover for ground-nesting birds. The rose hips, or fruits, persistent the year 'round, are fed upon by the pheasant, sharp-tailed grouse, prairie chicken (now called pinnated grouse), ruffed grouse, and many songbirds. There is some evidence that the large, hard rose seeds may, in the absence of sand, serve as grit for wintering game birds. Many other trees, shrubs, and vines including cedar, spruce, boxelder, ash, serviceberry, hawthorn, silverberry, cottonwood, plum, chokecherry, sandcherry, oak, sumac, buffalo berry, willows, and honeysuckle are much used in windbreaks and other types of woody plantings, and each of them contribute something in the form of food, shelter, or nesting cover toward the improvement of Northern Great Plains farms as suitable environments for desirable wildlife.

PLANTING SPOIL BANKS AND DITCHES

By R. E. CULBERTSON¹ and RICHARD M. MAY²

REVEGETATION of drainage ditches and spoil banks by direct seeding produces a vegetal cover that adequately protects the slopes and berms without impeding water flow, and yet is sufficiently aggressive to exclude undesirable plants. In addition valuable cover for wildlife is thus produced and the ditches are more easily maintained than when covered with wild plants that invade unmanaged sites.

Experience in the Northeast indicates that ordinarily good cover may be established by seeding in early spring or late summer. All necessary tillage operations should be performed at right angles to the slope; mulch should not be applied unless some provision is made for holding it in place with tobacco cloth, wire netting, or similar material. Critical areas may be sodded. In the Northeast, creeping red fescue, creeping bent, reed canary grass, ryegrass, tall oatgrass, and orchard grass have proved generally effective. Weeping lovegrass

has been outstanding in Delaware and Maryland. Companion crops such as oats or wheat may be used, and ryegrass included in the mixture provides quick protection. Protection from livestock is necessary, especially until the plants are established.

Spoil banks in wooded areas usually are not leveled. Such banks afford sites particularly useful to wildlife. Depending on the site and climate, direct seeding of woodland spoil banks should include reed canary grass, sericea lespedeza, and bush lespedeza. Here also it may be desirable to plant seedlings. Useful species are coralberry, silky cornel, arrowwood, hazelnut, bayberry, blueberry, huckleberries, Virginia creeper, honeysuckle, and trailing raspberries. An ideal planting plan includes a narrow band of rushes (*Juncus*) at the toe of the ditch slope, a grass such as weeping lovegrass on the slope, and sericea lespedeza or a suitable shrub on the 10- to 15-foot berm.

With such treatment croplands adjoining ditches become accessible to a larger number of farm wildlife species, and openings through woodlands are transformed into more widely usable wildlife habitats.

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MORE RUFFED GROUSE FROM WOODLAND MANAGEMENT

By FRANK C. EDMINSTER¹



Lumber, posts, fuelwood, ties—these are not all that a northern woodland can produce. If management is properly planned, a goodly supply of ruffed grouse can be assured. Significantly, the best management methods for wood products, game bird, and soil conservation, are identical.

IT IS now a recognized fact that management of the farm woods should be based on a broader interest than production of wood products—soil preservation and watershed protection are vitally important. Likewise, where grouse are indigenous, the needs of this valuable game bird should be met.

The whole ecology of the bird must be considered, particularly its food and shelter requirements; these must be translated into simple practices that will fit into general woodland management. The ruffed grouse is essentially a woodland bird and its presence depends in large part on how man handles the woods in which it lives. Hence, management of grouse is of necessity a form of woodland management. Some of the usual woodland management practices are beneficial to grouse while others may be definitely harmful. By emphasizing the former and avoiding the latter, good management of the farm woods provides a habitat suitable for grouse.

Good grouse habitat is an uneven-aged stand, largely second growth, composed of both hardwood and coniferous types, well interspersed with shrubby margins, glades, and open edges. Hemlock, spruces, and soft pines afford the best cover, especially when in clumps. Oaks, cherries, and beech provide nuts and fruit when allowed plenty of sunlight; and

birches, poplars, cherries, and hophornbeam are of particular value for their palatable buds.

The first requirement of both trees and birds is elimination of fire and domestic livestock. In some places this protection alone will bring considerable improvement, but the major opportunities for increasing grouse populations lie in the cutting operations, whether improvement cuttings or harvest. Distribution of age groups of trees requires a selective cutting system, not a clear-cutting job. Second-growth woodland will result if all crop trees are removed as they reach full size and if only the few trees needed for seed production are left. The distribution of types may be influenced by selective cutting according to species, favoring in one place the kinds that make a good conifer stand, and in other places those that make a good hardwood stand. In all cutting work, attention should be given to the preservation of those varieties of woody plants most valuable for grouse shelter and food.

Additional shrubby cover may be provided by keeping woodland roads brushed out, and by using the group-selection system of cutting to form numerous little glades. Shrub borders along edges where woods adjoin open fields may be developed by cutting all trees for a distance of 25 to 50 feet into the woods. Species of shrubs, vines, and small trees to be favored

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(Continued on p. 262)

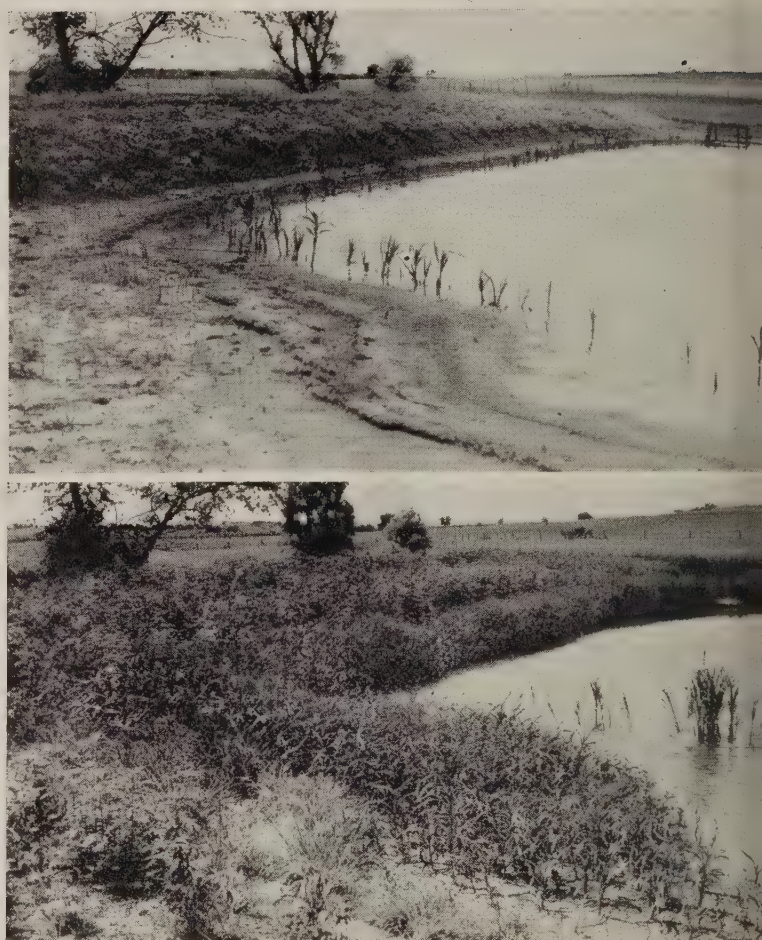
A STORY OF POND PROTECTION

By STANLEY W. AUSTIN¹

April 22, 1941.—On the earth fill of H. E. Talley's new farm pond in the Osage County Soil Conservation District, Kansas, a row of river bulrush was planted April 22, 1941, to protect the dam from wave action. The plants were hauled from a marsh, lifted with a spade, and transported in pails of water to keep the roots from drying. Most of the top growth was cut off and the roots, spaced 6 feet apart, were pushed into the mud in 2 or 3 inches of water. (Three-square rush, giant bulrush, and giant bur reed are also being used for this purpose.)

September 25, 1941.—Five months later the plants have spread from underground runners and developed a mat of vegetation at the water's edge. Because river bulrush does not grow in deep water it will remain confined to a narrow zone at the edge of the pond. This pond is in a hay meadow and water is piped to a tank in the pasture below; for, to remain useful, such plantings must be fenced or otherwise protected from livestock. In addition to protecting the dam, the vegetation has created a home for muskrats, redwing blackbirds, and other wildlife.

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WATER FOR WILDLIFE IN THE SOUTHWEST

(Continued from p. 258)

hand, and birds and mammals must expose themselves to enemies in order to obtain water. This harmful feature will be removed if the pond and a desilting area above it are fenced. The water may then be made available to livestock by piping it to a trough below the pond or by placing water gaps in the fence. A desilting area should always be fenced even if the pond can not be. Such an area not only provides cover for wildlife but also prolongs the life of the pond through reduction of siltation.

The springs of the Southwest are never large, hence their scanty supply of water must be carefully husbanded. This is best done by fencing the spring and constructing a trough or a catchment basin from which livestock may drink. Fencing will prevent stock from trampling the spring; the increased vegetation will protect the spring from siltation and will provide cover for wildlife.

Although water is a limiting factor in the distribution and abundance of wildlife in the semiarid regions,

there are many inexpensive ways in which wildlife may be provided with more water. All of these are pointed toward conserving water, and preventing siltation and pollution—thus they are of equal value to agriculture and contribute to good land use.

MORE RUFFED GROUSE FROM WOODLAND MANAGEMENT

(Continued from p. 261)

in such places are hawthorns, apples, brambles, dogwoods, viburnums, sumacs, grapes, blueberries, greenbriers, bayberry, cherries, roses, and hazelnut. In the woodland understory, the mountain laurel, wintergreen, partridge berry, viburnums, and the ferns are especially useful, while along woodland roads valuable foods may be available from the sedges, clovers, and strawberries.

Through good woodland management, and by encouraging the plants that make good grouse habitat and provide needed cover types in a well interspersed pattern, larger populations may be had of that prince of all birds of the northern forests, the ruffed grouse.

STERILE STREAMS TAKE ON NEW LIFE

By HOWARD C. HASS¹

Banks of streams are easily eroded, and have always been critical places as far as land use is concerned. They cannot be cultivated, nor should they be grazed except rarely. They can be used, however, to produce wildlife, if properly managed.

IN THE rugged terrain of La Crosse County, Wis., torrential storms cause serious damage to bottom-land fields and pastures if no measures are taken to control erosion and flood waters. First attempts at streambank control, by use of brush and rock dams, piling, riprap and similar structures, did not give sufficient protection. The brush and piling rotted, torrents carried away the rock, and channel straightening increased the gradient and destructive power of the stream.

On a few farms, however, the streams were fenced, except at places where stock could be watered. Willows were placed on the outside of curves; brush and rock dams were constructed; clumps of shrubs and conifers were planted; and black locust was established along the edges for future fence lines. Streambank control was thus improved.

Other farmers experimented still further. To eliminate expense and labor they merely fenced the streams and left them in the hands of the healing forces of nature. Thus livestock could not reach the streambanks, and in a year or two heavy sod and volunteer willow growth protected the raw banks except at the

more critical points. These points were then treated with brush and rock. Besides saving labor and material costs, these farmers attained their goal of streambank protection with the tools at their disposal.

Wildlife was not slow to take advantage of the cover provided along the protected streams. As one farmer commented: "Hunters are getting pheasants and rabbits today out of cover that just wasn't there a couple of years ago." Another, owning about 80 rods of protected stream, made this remark: "My part of the stream had more trout and was fished more this year than ever before."

Not all streambank problems in La Crosse County are solved, and only a small number of farmers having such problems have attempted any treatment. There is little doubt, however, that more of them will soon learn the advantages of treating streambanks as part of a program aimed at complete watershed protection against soil erosion—then raw banks will disappear and the sterile streams will take on new life. It is significant that the supervisors of the La Crosse County Soil Conservation District have adopted the policy that protection from grazing is a prerequisite to getting help from technicians or obtaining labor assigned to the district.

¹ Assistant soil conservationist, Upper Mississippi Region, Soil Conservation Service, Sparta, Wis.

BARBED WIRE CONSERVES SOIL AND WILDLIFE

By PHILIP F. ALLAN¹ and PALMER R. SIME²

THE most obvious factor that limits many species of wildlife in the Great Plains is the unsuitable interspersed cover in relation to food. Often there may be a total absence of cover. The vast flocks of mobile seed-eating birds indicate that food supplies, particularly waste grains and the seeds of weeds and grasses, are abundant. However, more sedentary species such as the scaled quail, are hard put to reach food at all seasons, since the food plants generally lack the qualities necessary for shelter. The use by quail

of a bare barbed-wire fence is a plain indication of cover deficiencies; it is a common sight to see a covey of these birds running beneath the bottom wire and dodging posts only to return to the meager protection of the wire.

The barbed-wire fence, used to enclose small areas, can quickly remedy cover deficiencies and at the same time serve as a soil-conservation measure. In a single year, weather favoring, the protected vegetation becomes adequate to serve both purposes. Rangeland ordinarily has many small spots that need erosion control, yet which contribute little food for livestock, Box canyons, gully heads, rocky knolls, escarpments,

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sand blows, and galled spots are the principal places that should be given protection. That the fence is of prime importance in protecting such sites has been shown by its use on 91 farms and ranches in the Texas Panhandle during the past year—here can be seen a truly surprising recovery of the vegetation within fenced areas. Weeds and grasses grew to an average height of 2 feet, and the density of this vegetation was sufficient to control erosion despite the heavy rains of 1941.

A recent check of 10 fenced areas near Memphis, Tex., revealed some interesting data. The areas varied in size from 1 to 20 acres and were principally on sand blows and galled spots. The vegetation, noticeably heavier in these enclosures than in adjoining lands, was predominantly sand dropseed (*Sporobolus cryptandrus*), with sunflower (*Helianthus annuus*), Texas croton (*Croton texensis*), ragweed (*Ambrosia* sp.), pigweed (*Amaranthus* sp.), three-awn (*Aristida* sp.), and buffalo bur (*Solanum rostratum*), which are locally abundant. Here and there were scattered mesquites (*Prosopis chilensis*) and Texas buckthorn (*Condalia obtusifolia*). An example of the effectiveness of the fenced area for erosion control is particularly evident on one 12-foot gully where sufficient growth of grasses and weeds has developed during the past year to halt further cutting.

A limited survey of wildlife using these areas showed that 5 of the 10 were headquarters for coveys of bobwhite and scaled quail. One covey of 27 bobwhites was flushed, and many dust baths and roosts were found. Other wildlife seen, or evidence of wildlife using the enclosures, showed clearly that they serve as feeding sites for mourning doves, den sites for skunks, and rest spots for many small birds.

DEERWEED

By R. M. BOND¹

THROUGH most of western and southern California the native deerweed or broom deervetch (*Lotus scoparius*) plays an important, though generally unnoticed, role in preventing erosion by rapidly occupying road fills and cuts, eroded spots, loose sand, and areas of thin soil.

The plant is a perennial legume, short-lived and slightly woody at the base. The many stems that ascend from the crown to a height of from 1 to 4 feet bear numerous red and yellow pea-like flowers in spring and early summer. By autumn the flowers and leaves have fallen to make a good ground litter, and

the bare green stems assume a broom-like appearance. The small seeds, much relished by quail and other wildlife, mature and drop during summer and autumn; and the plant itself is eaten by deer, goats, sheep, and horses, but cattle seldom use it.

Although somewhat difficult to cut because it is tough and wiry, field trials in California show that deerweed is a good erosion-control plant when used as a mulch for galled and rilled areas, particularly if it is applied when bearing seed. It has an advantage over many other "weeds" that will grow on similar sites, in that it offers little competition to more desirable plants, and dies out as they replace it, after having prepared and enriched the soil for its successors. Further tests are being made to prove its value.

WILDLIFE LAND

Soil conservation surveys, from which classes of land according to use capability have been developed in several hundred localities widely distributed over the country, reveal that about 2½ percent of all land in farms and ranches is unsuited for cultivated crops, hay, pasture, or woodland, because of its physical character. Based on this percentage, about 25,000,000 acres are classed as agricultural land that is well suited to production of wildlife, especially since the individual tracts occur in association with good land.

In addition, there are many millions of acres that cannot be farmed because of their location or position. This includes land in fence rows, railroad embankments, farm road rights-of-way, small corners in crop fields, and streambanks. For example, there are 2 million miles of streams on agricultural land in the United States, as estimated from representative surveys made by the Geological Survey and the Soil Conservation Service. This amounts to about 6 million acres of streambanks, if we consider 12 feet¹ on each side of the stream as unfit for farming. On the basis of census figures, it is estimated that there are in addition nearly a million acres of wildlife land along the banks of drainage and irrigation ditches.

The total amount of land that is suited for wildlife production only—because it is unsuited to any other kind of crop—is not known. On the basis of the above figures, it amounts to 33 million acres on farms and ranches alone.² Conservative as this is, the wildlife lands of agriculture amount to an acreage greater than that of all the land in the State of New York.

¹ The figure actually should be larger than 12 feet. A very conservative width has been chosen in order to avoid any possible overlapping of figures in the first paragraph.

² These estimates are included in the figures presented in the Report of the Chief of the Soil Conservation Service for 1941.

¹ Chief, regional biology division, Pacific Southwest Region, Soil Conservation Service, Berkeley, Calif.

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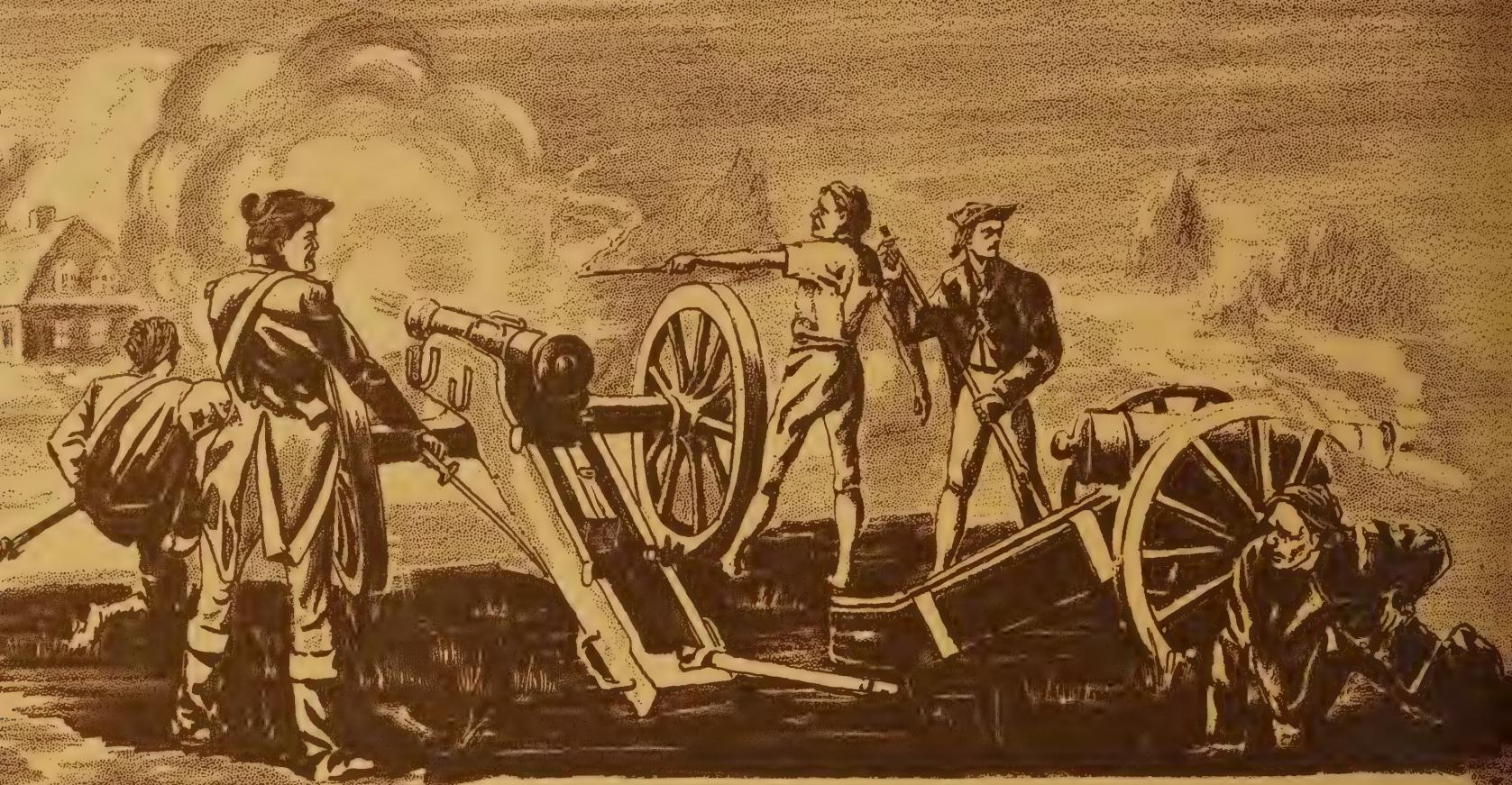
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¹ Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

² From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



Whilst our belligerent situation blocks up the channels of external commerce, and calls our citizens to the fields of warfare, thereby abstracting from agriculture, the labourers it demands; it is the more necessary to know how to use the number spared to us, with the greatest economy and advantage. In such case we must endeavor to raise the greatest product, from the more limited surface to which our capabilities, as to labour and means, reduce us. That this can be done, in no small degree, by superior attention and management, no doubt ought to be entertained

*Philadelphia Society for Promoting Agriculture
in the year 1814.*





MAY 1942

**INCREASED YIELDS
FROM CONSERVATION**

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

For immediate reading—on the MUST list—is R. E. Uhland's article which begins on the back cover of this issue. Here are **THE FACTS** about conservation farming and yields. The author has drawn from the results in East, South, Southwest, and Corn Belt to prove that soil conservation is the key to needed production.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

Drainage and the Food for Freedom Program: By James Turnbull.....	Page 265
The Facts About Conservation Farming and Yields: By R. E. Uhland.....	Back Cover and 266
Hill Culture for National Defense—and After- ward: By Maurice Brooks.....	270
King Grass Returns to the Kingdom of Callaway: By Philip K. Hooker and Cleo H. Statton.....	273
Shore Erosion on the Chesapeake: By John Cotton.....	277
Big-Scale Demonstration of Putting Soil Con- servation on the Land: By Ernest Carnes.....	279
Utilization of Range Plants on Wyoming Winter Sheep Ranges: By Kenneth Fiero.....	281
Human Conservation in Northern Wisconsin...	284
Book Reviews and Abstracts: By Phoebe O'Neill Faris.....	287
For Reference: Compiled by Etta G. Rogers.....	Opposite 287

Front and Back Covers
By Katharine R. Johnson

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

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Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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MAY • 1942

DRAINAGE AND THE FOOD FOR FREEDOM PROGRAM

By JAMES TURNBULL¹



You can't farm under water.

THE Department of Agriculture is requesting an increase in farm production for 1942 which calls for the greatest effort in the history of American agriculture. New high goals have been set in order to meet the needs of a world at war. The attainment of some of the goals will be difficult, but it can be done—it will be done.

The farmer faces a shortage of labor. Requirements of the armed forces and increased industrial activity combine to limit the supply. Farm machinery will be hard to get. Shortages of critical materials are forcing limited production of machinery used in farming operations.

To counteract these difficulties it is necessary that every farmer make the most efficient use of "every acre of land, every hour of labor, and every bit of farm machinery, fertilizer and other supplies" available.

Improved soil-conserving practices, new seed varieties, and adequate supplies of fertilizer will help us

achieve our goals. But of all the farm practices that can increase our food production, there is none that is more important or that will yield more immediate results than adequate drainage. The low farm incomes of the past two decades have made it difficult to raise sufficient funds for maintaining drainage improvements, and the result is that literally millions of acres of poorly drained fertile land now are unable to produce more than a partial crop. This land requires the same amount of labor for cultivation, the same quantity of seed and fertilizer, and uses the same machinery as land capable of producing a full crop.

Have you ever traveled along a country highway with fields on each side of the road? Perhaps the fields are in corn, or wheat, or rye. A beautiful stand, but marred by small areas that are not doing as well as the rest, or bare spots here and there. Then, you may have traveled this same road again after a rain and seen the water standing in these very same areas where the crops look poorest—you can find such spots on most of the farms of the country. They are small

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areas mostly; but sometimes whole fields, and occasionally even extensive areas are in this condition. Usually they are low places where water accumulates after a rain because its only means of escape is through percolation into the soil. Some of the spots are seep areas, kept wet by moisture seeping through the soil from a higher area. The extensive areas are usually those provided with inadequate field or outlet drainage. Can we afford to allow these areas to continue to produce poor crops? Dare we gamble with our freedom when we know that increased crop production will help "win the war and write the peace?"

The magnitude of the area that can be improved for agricultural purposes through drainage is realized by only a few people. It is estimated that in organized drainage districts alone there are almost 25 million acres that are under varying degrees of cultivation but which require drainage rehabilitation in order to make normal yields possible. In addition, over 6 million acres of cultivated land outside of drainage districts require improved drainage outlets. This does not include any of the land needing only field ditches or tile lines for the proper drainage of individual farms, fields, or low places.

Thirty-one million acres of land under partial cultivation requiring drainage improvements other than tile lines and small field ditches—land that could yield millions of bushels of additional crops without use of any more machinery, any more labor, any more seed or fertilizer! It is fertile land, well suited to crop production. Most of it is bottom land free from erosion. Adequate drainage of this land would provide a considerable portion of the increase in crop production required in 1942. It is land requiring no new development, no new roads, or bridges, no new schools—land that can be improved without disturbing wildlife or recreational areas—land that can be drained with a minimum of expense.

In addition to this 31 million acres, there are thousands of farms throughout the country requiring some degree of field drainage. On most of the nation's farms, drainage could increase present crop yields. Drainage of low spots and seep areas not only would increase production on these areas but would make possible the most efficient use of farm labor and machinery.

Seep areas interfere with such soil-conserving practices as contour cultivation, strip cropping, and terracing. Low spots may delay cultivation, planting operations or harvesting, until the soil has dried out sufficiently to allow normal field operations. This may result in decreased crop yields for an entire field. During this period of national emergency we must do all in our power to prevent these lowered yields and crop losses.

As the action agency of the Department charged with instituting proper land use and conservation practices, it is imperative that we of the Soil Conservation Service become drainage-minded. We must go to the farmer with a positive drainage program. By providing technical assistance in the design of adequate drainage systems we can avoid many of the pitfalls of earlier drainage works. Too frequently, ditches have been dug and tile lines installed without proper consideration of all the factors involved. Districts have been organized, and ditches have been dug only to have them fill up with silt from eroding hillsides; infertile land has been unable to carry the burden of drainage taxes and has been abandoned; lack of engineering design has resulted in completely inadequate ditches that fail to provide sufficient runoff capacity and cause reduction in crop yields or total crop failure.

All of the resources of the Soil Conservation Service are pledged to the success of the food for freedom program. Expansion of the drainage work of the Service will contribute to this success.

The Facts About Conservation Farming and Yields

(Continued from back cover)

Conservation measures applied to cotton fields in the Southern Great Plains also greatly increased yields. Near Spur, Tex., the yield of lint cotton on contoured land with closed level terraces was 68 pounds per acre more than on adjacent untterraced and non-contoured land. The value of this increased yield of cotton, figured at the average price per pound received by farmers for each year of the 12-year period, 1927 to 1938, was \$7.60 per acre each year. There were 3 years of crop failure in this 12-year period when two

crops were destroyed by hail and one crop failed because of two extremely dry years in succession. If these 3 years were omitted, the annual return per acre from the terraced and contoured field was \$10.13 greater than the return from the untterraced and un-contoured field.

The effect of contouring and terracing on the yields of grain sorghums was demonstrated in the high plains of Texas in 1937. The average yield of grain from 20 terraced and contoured fields was 723 pounds per



The contoured basins in this gently rolling field increased the moisture retained in the soil and reduced erosion to a minimum.

acre as compared with a yield of 589 pounds per acre from land that was contoured only and a yield of 461 pounds per acre from land where neither contouring nor terracing was practiced. These increases were more significant on the heavier and finer-textured soils where water conservation was highly important.

In South Dakota, the average yield of small grains on contoured land over a 3-year period was 6 percent more than on land that was not contour-farmed. The yield of grain sorghum as a listed row crop was 19 percent greater than when surface-planted. This study shows the practical importance of listing for holding the topsoil. In 1940 the deeper topsoil produced 90 percent more grain than soils in the same area which had lost most of the topsoil. In 1941 the difference was 59 percent.

In the Northeast at Beemerville, N. J., land planted to corn and cultivated on the contour yielded 3 tons more silage per acre than corn planted up and down the slope. The contoured land lost but one-half as much water and one-eighth as much soil as noncontoured land planted to the same crop. In 1938, the yield of green silage from a field planted to a soil conserving grass legume mixture was 14 tons per acre, as compared to a green silage yield of 9 tons per acre from an adjacent plot of corn cultivated up and down the slope. This practice is applicable and can be used profitably on many farms throughout the Northeast.

Potatoes at Beemerville, N. J., in 1941 yielded from 8 to 15 bushels more per acre when planted on the contour. In 1940 the increased yield from contoured land was 23 bushels per acre.

In the potato section around Presque Isle, Maine, both increases and decreases in the yield of potatoes

have been reported. The decreases, however, were associated with ponding of water which injured the quality of the potatoes. Preliminary studies show that these defects can be corrected and contour farming can be effectively and economically used in potato production.

For a 6-year period an old established field of Concord grapes that was planted and cultivated on the contour produced an average annual yield of 4,842 pounds of grapes per acre as compared with a yield of 3,933 pounds from adjacent land cultivated up and down the slope. For the 4-year period, 1936 to 1939, when moisture was very limited, the contoured land yielded from 600 to 2,500 pounds of grapes more per acre than land with rows planted up and down the slope. In 1940, however, the rainfall was higher and better distributed, and as a result the yield of contoured grapes was 200 pounds less than that of uncountoured grapes. This slight difference occurred but once in the 6-year period, whereas the average increase in yields from contour farming was 23.1 percent.

In the Blackland region near Temple, Tex., for a 4-year period, 1936 to 1939, terraced and contoured fields produced an annual average of 67 pounds of lint cotton more per acre than comparable untterraced and uncountoured land. This represents a difference of 33 percent. The yield of corn from terraced and contoured land for the same period was 3.8 bushels per acre greater, or 13.8 percent more than that from land not terraced or contoured.

The yield of corn at Zanesville, Ohio, declined where corn followed corn year after year. The average yield for this 5-year period was 20.4 bushels per acre when planted and cultivated up and down the slope.

Corn grown in rotation with fertilizer and lime and contour strip-cropped increased in yield from 31 bushels in 1935 to 55 bushels in 1939.

At Clarinda, Iowa, contour-listed land planted to corn yielded 56.1 bushels per acre in 1933, while non-contour-listed land produced only 33.1 bushels. For a 6-year period that included 3 dry years when chinch bug and grasshopper injury was severe and little corn was produced, the average yield for contoured land planted to corn was 30 bushels as compared with a yield of 18 bushels from noncontoured land. This represents a difference of 12 bushels per acre in favor of contour farming. During this 6-year period, the contoured area retained 13 inches of rainfall more than noncontoured land. This represented an average annual saving of more than 2 inches of rainfall and indicated that every inch of water saved resulted in an added yield of 5½ bushels of corn per acre.

Contouring of intertilled crops is on the steady increase throughout the country and can be profitably extended. According to the Agricultural Adjustment Administration, almost 6½ million acres of land was contoured in the southern region alone last year. Records show that practically no contouring was practiced in Iowa as recently as 1935.

In Montgomery County, the county agricultural agent reported that approximately one-half of all the corn grown in 1941 was planted on the contour. This county in southwestern Iowa is located near the soil conservation experiment station and an old demonstration project. That this case is exceptional is indicated by Agricultural Adjustment Administration records for 1940 which show that payments were made for less than one-quarter million acres of contoured land within 5 Corn Belt States. It is recognized that payments were not made on all contoured land in these States.

Should this conservation practice be extended to one-third of the corn acreage of the Corn Belt, the annual production of corn would be increased by almost 100,000,000 bushels. This estimate is based upon hundreds of observations and is supported by experimental data.

At the New Jersey Experiment Station, tomatoes grown in alternate years with Sudan grass showed a 33-percent greater yield than tomatoes grown year after year on the same land. The mulching of tomato vines with 3 tons of straw per acre almost doubled the yield of tomatoes and improved both size and quality. Raspberry fields similarly treated increased in yield from 35 to 75 percent.

Champaign grapes that were mulched with straw at

Hammondsport, N. Y., in 1939, yielded an increase of 98 pounds of grapes for each 100 vines over those not mulched. This represented an increase of 80 percent in the first crop harvested for the young vines.

On the Soil Conservation Experiment Station near Athens, Ga., it was demonstrated that critically eroded areas in the Southeast can be effectively cropped to lespedeza by adding lime and superphosphate and applying a light straw mulch. Without the mulch, the crop failed completely, but wherever a mulch was used a yield of 1½ to 2 tons of hay per acre was produced. This yield was quite comparable to the yields on the station from average cropland receiving the same fertilizer without mulch.

The practice of utilizing crop residues for surface mulching is quite different from the old method of burning or plowing under trashy vegetation and promises to change greatly the agriculture of many sections of the country. The problems presented in the utilization of crop residues vary widely in different sections of the country, and for this reason extensive studies are being carried out to determine the most practical adjustments needed for the different sections.

In order to secure factual information regarding the effect of soil loss on crop yields, a large number of fields were studied in Indiana, Iowa, Missouri, and Ohio. Since management is known to influence erosion, fields were purposely selected to represent different types of management. In table 1, the summary data for Fowler, Ind., and Bethany, Mo., show the very definite relationship existing between depth of topsoil and corn yields. Similar data were secured for Coshocton, Ohio, and Greenfield and Shenandoah, Iowa.

TABLE 1.—Depth of topsoil with yield of corn and percent of field represented by each depth class. Average for a large number of fields at Fowler, Ind., and Bethany, Mo., 1939 and 1940.

Depth class (inches)	Fowler, Ind.		Bethany, Mo.	
	Field area	Yield	Field area	Yield
	Percent	Bushels per acre	Percent	Bushels per acre
0.....	1.0	19.8	0.5	15.2
1 to 2.....	3.5	39.6	3.9	24.9
3 to 4.....	10.4	48.8	24.0	27.3
5 to 6.....	19.0	56.9	27.3	35.2
7 to 8.....	25.3	63.3	27.3	41.2
9 to 10.....	16.4	69.6	12.1	47.2
11 to 12.....	14.3	75.5	4.0	51.0
13 or more.....	10.1	81.5	1.0	57.4

A striking example of the effect of conservation farming on production is furnished by 2 fields of Shelby silt loam near Bethany, Mo. The fields had been handled similarly prior to 1935 when a 3-year rotation supported by liming, manuring, fertilizing,



Research findings at Lincoln, Nebr., show that the utilization of wheat stubble as a surface mulch markedly reduces runoff and erosion. Burning increases erosion and runoff and lowers crop yields.

and contour cultivation was initiated on one field. The other field was managed according to the old system of farming and no treatments were added.

In 1940, 5 years after conservation farming was initiated on one of these fields, a survey was made, the results of which are shown in table 2.

It will be noted that there is a close relationship between soil depth and yield on both fields, but there is a striking contrast in production levels. The average yield of corn for the treated field was 69.7 bushels per acre as compared with a yield of 32.5 bushels for the untreated field. Almost one-half of the area of the untreated field measured less than 5 inches in depth of topsoil; whereas, about one-fifth of the treated field fell into this depth class. The average depth of topsoil for the treated field was 5.9 inches as compared with a depth of 4.6 inches for the untreated field.

Observations showed that the soil losses from the field on which conservation measures were applied were very small since 1935, but the losses from the check-field were extremely large. It is recognized, of course, that these fields were not perfect checks; but it is significant that the field on which conservation farming was followed yielded more than twice as much as the field on which conservation practices had not been applied.

TABLE 2.—Effect of conservation farming on depth of topsoil and yield of corn, Bethany, Mo.

Depth of topsoil (inches)	Exploitive farming		Conservation farming (Since 1935)	
	Field area	Yield	Field area	Yield
	Per- cent	Bushels per acre	Per- cent	Bushels per acre
0 to 2.....	20.5	20.6	4.6	50.7
3 to 4.....	26.7	27.0	16.6	60.0
5 to 6.....	31.4	38.6	43.7	66.7
7 to 8.....	17.1	41.1	25.8	80.0
9 to 10.....	3.8	42.4	6.6	84.0
11 to 12.....	0.5	51.4	2.7	76.0

These results are in line with findings of State agricultural experiment stations. For example, the Indiana State Experiment Station reported an average yield of 39 bushels of corn per acre for untreated land cropped annually to corn, as contrasted with an average yield of 61 bushels from adjacent land treated with fertilizer, lime, and crop residues, and cropped to a 4-year rotation of corn-corn-wheat-clover. Under a 5-year rotation of corn-corn-soybeans-wheat-clover in a livestock system of farming where fertilizer, lime, and manure were used, the average corn yield was 64 bushels per acre. These yields were taken during the 11-year period, 1928 to 1938. In both livestock

(Continued on p. 276)

HILL CULTURE FOR NATIONAL DEFENSE—AND AFTERWARD

By MAURICE BROOKS ¹

WE are living in times when every pound of food, every dollar of revenue, and every productive effort becomes an integral part of our national effort to secure our own national safety. Particularly significant and valuable is every bit of production of food. Not only must we find new sources to supply our present needs but we must also look ahead to the time when a war-weary and starving world will turn with out-stretched hands to America, asking for food and for the materials with which to rebuild their shattered civilizations.

These needs make it necessary for us to explore every means to find or create new ways to use wisely our natural resources. It is with such exploration and creative effort that "hill culture" is primarily concerned.

That we have the hills no one can deny. That we are receptive to suggestions for improving those hills—their sod or the forests that cover them, their capacity for supporting more domestic or wild animals, their yield in cash income for the owner—will be evident to anyone with a discerning eye who travels our roads. Here can be read the story of strip-cropping, contour furrowing, spot planting, and other steps in the program for conserving our basic resource, the soil.

Thousands of our farmers are taking steps—and important steps they are—to improve their soils and to conserve their water supplies. In West Virginia there is a program for getting 9 million acres of land that is suited only to the growing of trees into forests—forests that will be productive not this year only, but every year. The State Conservation Commission, the United States Forest Service, and the Division of Forestry of West Virginia University are united in the effort to put our forest lands on a sustained yield basis, the only basis from which the landowner can expect a steady though sometimes small income, and the only way in which the State's great wildlife resource can be used and preserved.

"Hill culture" is designed primarily to fit into these larger programs in a supplementary capacity. Its immediate aim is to select and utilize superior strains of erosion-resisting plants of high economic value so that sloping land too steep for cultivation, often too steep for terracing, will not be washed away.

Let us look briefly at some of the steps in the "hill culture" program, each one perhaps small in itself, but each capable of becoming a unit in a mighty whole.

For the last several years we have been mourning the passing of the American chestnut, our most important source of hardwood lumber, our finest game food, and the means to a certain source of extra spending money for thousands of people.

In recent years I have occasionally seen cars from Indiana, Tennessee or some other southern or western State, pulled up along West Virginia roads and offering for sale (at 25 or 30 cents the pound) good-looking chestnuts which neither in flavor nor appearance were much different from our native nuts. These were Chinese chestnuts, grown on trees that are largely resistant to the blight which swept away our American trees. Chinese chestnuts are in no sense a complete replacement for our own species. The trees do not grow, ordinarily at least, to timber size; they are still expensive, and the nuts are not quite up to the quality of our own. Nevertheless, they are good to eat; they sell well, and the trees will live, thrive, and produce good crops in many parts of West Virginia. Furthermore, they have one distinct advantage in that they bear at an early age; good crops can be expected within 10 years or less.

I believe that a few trees of the Chinese chestnut will be a good investment on West Virginia farms, particularly in the Ohio, lower Kanawha, lower Monongahela, and South Branch Valleys, and in the eastern panhandle region. Despite high initial cost they give every promise of succeeding and bearing well at lower altitudes. At Oglebay Park in Wheeling, may be seen bearing trees that produce, and produce well, annually. At elevations much above 1,500 feet I would plant with caution, and on an experimental basis. At our French Creek farm (elevation 1,700 feet) we have had Chinese chestnuts under cultivation for about 25 years, and the history of the planting is that the trees have done well in ordinary years, have even produced some fair crops, but when we have a winter of unusual severity—that of 1935-36, for example—the trees apparently become weakened to the extent that they are heavily injured by blight during the following summer.

For a number of years the College of Agriculture of West Virginia University has been collecting and

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Pickers stripping fruit of lowbush blueberries, *Vaccinium angustifolium*. Note dense cover, an erosion control advantage. Many high elevations of West Virginia are covered by this species and the fruit is collected annually by thousands of persons.

planting nuts from chestnut trees that have shown some resistance. A surprising number of these has been reported in the State, and persons knowing of such trees will be doing a public service in reporting them to Dean C. R. Orton at Morgantown. Hundreds of these seedlings are now growing on the University farms, and some of them have indicated considerable immunity to the blight.

An important part of the planting program being carried on by the Soil Conservation Service consists of efforts to establish and encourage stands of our native black walnut. The excellence of this nut needs no tribute from me, nor can there be any doubt about the salability of the kernels. Many native trees, however, bear nuts with thick, hard shells, making cracking difficult and resulting in a slow extraction of the kernels, with a broken and unsatisfactory product. Many persons have felt that the return did not justify the effort, and untold thousands of bushels of black walnuts have frozen on the ground, a completely wasted farm product.

There are several things that can be done about this. Walnut trees, when grown from seed, do not come true to the parent stock, but there is good evidence that seed selected from good trees will tend to produce better nuts in the offspring. Every person raised on a farm will be aware that there is great variation in the

flavor, size, and cracking qualities of nuts borne on different trees. Careful selection of seed nuts therefore would seem well worth while.

Several of the finest native walnuts ever discovered have been named and placed in cultivation. These varieties, available from various nurserymen, produce nuts of high quality, thin shells, and excellent cracking qualities. When a market is once established they command premium prices; the trouble has been that the public has not come to recognize their advantages. This will change when enough of these improved walnuts are grown within the State. At French Creek, Upshur County, a variety known as the Thomas walnut has been particularly successful, the trees of rapid growth and of good bearing qualities, and the nuts superior. Stabler and Ohio are also good varieties of established reputation, and available from dealers. There are a number of newer varieties of great promise. Although the nursery-grown trees are expensive (they have to be grafted) they are, I believe, an excellent investment.

Thousands of pounds of European filberts used to be imported into the United States, the chief sources of supply being Spain and Italy. Most people are not aware that this larger relative of the native hazelnut can be grown easily and profitably in West Virginia. Filbert bushes planted at French Creek 20 years ago

have produced large crops, and have seldom had complete crop failures. Nuts produced locally are of excellent quality, and are, seemingly, as good for all purposes as the imported ones. One caution: the bushes are largely self-sterile; that is, they require other bushes for cross-fertilization. Good results can only be expected where two or more varieties are planted together. Barcelona, Duchilly, and Italian Red have all been good bearers in Upshur County. Occasionally early blossoms have been killed by frost, but none of the bushes has shown winter injury.

Other nuts have considerable value. English walnuts can be grown successfully in the latitude of our eastern panhandle of West Virginia, but it is well to remember that these trees are at home only on limestone. They should not be tried in acid soils. There are good improved hickories on the market, and an established market for the kernels, but the trees are of such slow growth as to discourage most people. The products of hybridization between native hickories and pecans, called "hicans," are available to the public. Nuts are excellent, but the trees are little more hardy, so far as producing crops is concerned, than the true pecan. They might produce well in the lower Ohio Valley.

Every season the Forest Service opens up parts of the Monongahela National Forest to the blueberry pickers, thousands of whom flock to Roaring Plains, Red Creek Plains, and other sections to pick the small, but luscious, fruit. They have keen competition from bears, and ever-present is the thought of a lurking rattlesnake, but the pickers go anyway. I never see anyone picking blueberries without thinking of the beautiful berries developed through selection and hybridization of native blueberries by the late Dr. F. W. Coville. These berries, first grown at Whitesbog, N. J., are now to be had in a number of varieties. Some grow on low, matted bushes; others have bushes that reach a height of 4 or 5 feet. Dwarf bushes have done well in recent experiments at the University of West Virginia where efforts are being made to develop plants of this type. The fruit on all types of bushes is large, some of the berries being grape-size, and of high quality. Some varieties are especially adapted to acid swamps; others do well on the same acid soils as are required by rhododendron and mountain laurel. The bushes are handsome, are well adapted to the home garden, and the berries have ready sale. A few bushes, well-selected, will furnish berries for a family throughout much of the summer season. This is a fruit that deserves a much wider planting than it has received in West Virginia. It may well be used to supplement the farm income.

On the hills overlooking the Tennessee River the TVA agencies have encouraged the extensive planting of Japanese persimmons. These fruits are much larger than, and not so astringent as, our native persimmons, and should be hardy up to 1,200 feet in West Virginia. Since a market for them is being developed in the Tennessee Valley region, the lower Ohio Valley would seem to be strategically located for such plantings.

One of our most neglected resources and one which holds the very essence of "hill culture," is to be found in our stands of sugar maple trees. Maple sugar and sirup give flavor to some of the most popular food products in the world—on the farm one of our deepest satisfactions was to be found in the "bilin' down" and the "sugaring-off." In a few sections (the region around Mt. Storm, Grant County, is notable) farmers are making extensive use of maple sap for sugar and sirup.

Every Christmas I see what is to me a rather pathetic sight. In front of the grocery stores, and in the gift shop windows are boxes and barrels of holly, scrawny stuff from New Jersey or Delaware, with drying leaves, scattered pale berries or no berries at all, their places being taken by wired-on artificial atrocities. And despite this—so ingrained is our feeling that holly is appropriate to the Christmas season—the stuff sells, and at good prices.

Then I think of the magnificent American holly trees that I know in Upshur, Braxton, Nicholas, Fayette, Wyoming, and other counties in West Virginia; trees of lovely form and foliage, bearing annual crops of berries in such profusion as to make one who has not seen them before gasp in astonishment. I remember, too, one tree that has been trimmed—and in some cases butchered—each year for 60 years—so my grandfather told me—and yet produces such unbelievably loaded twigs as I have never seen elsewhere.

Skillfully trimmed, a holly tree will go right ahead producing bearing woods, and crops of berries, year after year; in fact, the trimming may do the tree good. I can see no possible reason why the stores in Clarksburg, Charleston, Huntington, and Wheeling should import New Jersey holly. We have it at home in adequate quantities, and in quality far beyond anything that finds its way to the commercial market in the seaboard States. What we need at present is a realization on the part of the landowners that this market exists. When the true value of a good holly tree is realized the owner will protect it as he would any other desirable property. I believe that I know

(Continued on p. 286)

KING GRASS RETURNS TO THE KINGDOM OF CALLAWAY

By PHILIP K. HOOKER AND CLEO H. STATTON¹

GRASS lands once made Callaway County, Missouri, so prosperous and independent that it was often referred to as the "Kingdom of Callaway." A history of this county, published in 1884, states that, "Callaway County comes very near to being a stock breeder's paradise, the demand for all classes of well-bred stock always being in excess of the supply * * *. Not a single man of ordinary sense and business capacity in this county that has followed the one work of raising and feeding his own stock, abjuring speculation, and sticking closely to the business, has (or ever will) failed to make money. It beats wheat growing two to one, though the latter calling be pursued under the most favorable conditions in the best wheat regions. It beats speculation of every sort, for it is as sure as the rains and sunshine. What are stocks, bonds, options, mining shares, merchandise, or traffic of any character beside those matchless and magnificent grasses that come of their volition and are fed through all the ages by eternal God, upon the rains and dews and imperishable soils of such a land as this? * * *. By the side of the herds and grasses and herdsmen of such a country as this, the men of the grain fields are nowhere."

But "men of the grain fields" appeared later. During the first World War many of the farmers of Callaway County did not "abjure speculation" nor did they "stick closely to the business" of stock raising. Wheat was in great demand. Virgin grass lands on soils and slopes not suited to cultivation were plowed up. Corn, oats, and wheat sapped the fertility of the land, and erosion began to take its tremendous toll on those "imperishable" soils. Farms were divided, by sale of parts of them, into two or more farms. The result was a large number of small farms. Today many farms have only 40 or 80 acres—the average of all farms is about 118 acres. The County Land Use Planning Committee considers 160 to 175 acres about the minimum needed in the area to provide an adequate living. To try to make a living in this area from a farm of less than that means, generally, misuse of the land with resulting erosion and ultimate ruin of the soil.

Ruined land ruins the people on it. As prices of farm products declined, the farmers worked the

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Typical of the pasture land that will be revegetated in the Cedar Creek forest and pasture area.

soils still harder in an effort to meet interest on mortgages, increased equipment expenses, and to maintain some semblance of a decent standard of living. The droughts of 1934 and 1936 brought a climax to a situation which was already seriously affecting the agricultural economy of the area.

Naturally, this situation came to the attention of the Department of Agriculture and, in the summer of 1935, a soil conservation demonstration project and a CCC camp were established in Callaway County to cope with the problems. It was soon realized, furthermore, that some means would have to be found to supplement these eroded farms from which the operators could not make a living. The only measures deemed adequate to stabilize the economy of the area were (1) public purchase of some of the farms that had become most submarginal, and (2) improvement and management of the acquired lands for the benefit of the community—such measures to be supplemented by continuous encouragement of conservation farming by the operators of the remaining private lands. Accordingly, the Secretary of Agriculture on January 11, 1939, approved the establishment of the Cedar Creek Pasture and Forest Project under the provisions of Title III of the Bankhead-Jones Farm Tenant Act. This project embraces a total of 258,820 acres, of which about 90 percent is in Callaway County and the other 10 percent across Cedar Creek in the eastern edge of Boone County.

The Soil Conservation Service is acquiring, with funds made available to date, 12,913 acres in 21 separate blocks located throughout the west half of the project area. The average price paid per acre,

including improvements, is \$8.53 for the lands being acquired at present, and the average size of the farms is about 110 acres. The purchase of an additional 10,456 acres in the 21 blocks and 1,720 acres in two other locations is considered essential to effect fully the needed adjustments in the present purchase area of the project. This will make a total purchase of 25,115 acres, about 20 percent of the total land in this half of the project. The ultimate size of the blocks of land to be acquired in any one location will vary from 350 acres to approximately 2,600 acres, depending on the extent of the problem of submarginal farms in the location and needs for additional grazing lands by the remaining farms.

Purchases are made on an entirely voluntary basis. No one is being forced to sell his land. Sufficient farms qualifying for purchase under the act, i. e., "submarginal or not primarily suitable for cultivation," either are or will be for sale in the area, at the fair appraised prices which the Government pays, to enable the working out of the contemplated adjustments in land use without requiring any individual to sell his land unless he wishes to do so.

As the lands are acquired, and as funds are made available for the purpose, they are improved and protected from continued erosion. On those formerly cultivated lands best adapted to pasture, particularly those which will respond properly thereto, seed beds are prepared, limestone and fertilizer are applied, and seedings of legumes are made, to be followed by perennial pasture grasses. Gullies—and there are many in the area—are "bladed-in"; or other measures are taken to arrest their further damage and to bring the land back to useful condition. Lands already in permanent pasture are improved by various means according to the needs and the quality and condition of the soil, including interspersed seeding, liming, fertilizing, and mowing weeds and cutting brush. Fences are constructed to control the grazing that is to be permitted on the lands, as well as to protect the cover seeded or planted on badly eroded areas until it is well enough established to be used for grazing. Stock water is provided where needed by the construction of small ponds or development of springs at strategic locations for proper distribution of the cattle that will graze the lands.

Lands having a good growth of trees are allowed to remain as woods while open or brush lands not adapted to pasture use are planted to desirable species of tree seedlings and wildlife cover shrubs. Some thinnings and other woodland improvements are made and all lands are protected against fire.

These conservation operations are being carried out at present by the employment of farmers and other rural occupants of the area. This employment furnishes these people some much-needed cash and, at the same time, gives them first-hand experience in some of the conservation practices needed on their own farms.

As the grass cover is restored on the lands, permits are granted, at reasonable charges, to farmers in the vicinity of the various purchase areas to use the land for grazing purposes. Likewise, as condition of the woodlands warrants, permits will be granted to rural families to cut fuel, posts, and other timber materials. Permits are granted according to the needs of these farmers. A farmer having a farm of submarginal or marginal character because of size, condition of land or otherwise, and whose chances of making a decent living could be improved by raising some livestock or increasing his present small livestock herd, is given first preference in the granting of permits. Farmers granted such permits agree to conservation plans for their own farms. This last mentioned factor contributes materially to more rapid stabilization of the entire area, both physically and economically, by adoption of proper soil conservation practices and land use on the private lands as well as the public lands.

For a concrete illustration of the problem, the procedure followed and the objectives to be attained, let us look at one representative segment of the project comprising 23 farms totaling 3,590 acres.

Only 6 of these farms had the acreage recommended by the County Land Use Planning Committee as essential to provide a decent family living, namely, 175 acres. The average size of these 6 farms was 314 acres, varying from 196 to 583. By contrast, the other 17 farms varied in size from 22 acres to 160 acres, and averaged only 100 acres.

Of the 3,590 acres in this segment of the project, only 888 acres, or 25 percent, of the land is suitable for cultivation as revealed by the use-capabilities classification which is based on a detailed conservation survey of the area. Of the 888 acres, only 168 acres is class I land, requiring no special soil conservation practices; the other 720 acres is class III land, requiring complex or intensive erosion-control practices, if the land is to be cultivated. Moreover, of the 168 acres of class I land, 59 acres are in woods, and 47 acres of the 720 acres of class III land is wooded. It is feasible to clear woods from land in this area only in limited instances. Consequently, the amount of land which can be practicably cultivated is only 782 acres, or 22 percent.

In 1938, because of the small size of the average



This road may be abandoned in consequence of land purchases in the Cedar Creek forest and pasture area, thus saving the county expense of road maintenance.

farming units and the type of farming followed, 1,169 acres of land that is adapted only for use as pasture or woods was being used for crop production. This is 33 percent of the segment and the result is that there is much erosion in the area.

With such pertinent facts at hand, these 23 farms were classified according to their marginality—their ability to provide a satisfactory family living. Only the 583-acre farm could be classed as supermarginal, capable of returning a good income in unfavorable years. Seven farms were of the marginal class, i. e., capable of providing an adequate income only under favorable price and climatic conditions. The other fifteen farms were definitely submarginal or incapable of providing a decent family living even in “good times.”

While all of the fifteen submarginal farms would have qualified for purchase under the act, only eight of them were selected for purchase—the ones offering the least opportunities for rehabilitation. These eight farms had a total of 825 acres, with an average of only 103 acres per farm. Of the 825 acres in the eight farms, only 123 acres, or 15 percent, is suitable for continuous cultivation. On the other hand, of the 2,765 acres in the 15 farms to remain in private ownership, 765 acres (28 percent) can be continuously cultivated safely with proper practices. Of the 123 acres adapted to cultivation in the eight farms selected for purchase, 32 acres (26 percent) is in woods, as contrasted with only 8 percent for the same kind of land in the other 15 farms.

While this segment of the project is probably more

representative of the project as a whole than any other, the land acquisition and conservation operations in this segment are not quite as advanced as in some others. Only three of the eight farms selected for purchase actually have been purchased as yet. These three, totaling 338 acres, had been abandoned. The operators had given up the futile attempt to make a living from them. However, with completion of the acquisition and conservation operations work, a community pasture of 640 acres, and woodland of 175 acres, will be available to the eight remaining operators of submarginal farms and the seven operators of marginal farms. This will be of extreme importance in enabling these operators to increase their size of business and to work out adjustments in type of farming and character of operations so that they may have an improved basis for making a decent living.

Now, from these 15 farms that are to remain in private ownership in this segment of the project, let us take a more specific look at one of them, say the 160-acre submarginal farm belonging to a man we will call John Adams—we “sat in” when a conservation farm plan was drawn up for John’s farm.

John has a large family. He found that, with only 160 acres and the way he was farming it, he could not make a decent living from the farm alone, so he works out a large part of the time.

At present he has only 2 horses, 2 dairy cows, 2 brood sows and about a dozen hens. The farm comprises only 24 acres capable of standing continuous cultivation, although it does have 28 acres that can be used for permanent meadow—or can even be

cultivated for a short time at long intervals. Under his present "plan" he is growing 15 acres of corn for grain, 10 acres of small grains, 4 acres of sorgo and 18 acres of lespedeza hay. He is losing \$66 annually through the operation of his farm, and furthermore the farm is running downhill both figuratively and literally.

Under the farm conservation plan, if carried out, John will increase his animal units from about 5 to 35. The principal increase will consist of 15 beef cows, 3 beef heifers, 11 beef yearlings, 30 ewes, and 30 lambs marketed at 4 months of age. His crops will be changed to 6 acres of corn, 6 of small grains, 7 of lespedeza hay and 24 of mixed hay.

He will have 103 acres of pasture of which 79 would be open and 24 with scattered woods and brush. The plan calls for improvement of the pasture by liming and fertilizing with superphosphate, as well as grass seeding of some formerly cultivated land. All of the crop land will have to be terraced. Even after this plan is fully effected and his farm productivity restored, he will need about 30 animal unit months of grazing in the community pasture previously mentioned.

During the 10 years that it may take John, with his limited financial resources and average ability, to put this plan into full effect, he will need 68 animal-unit months of grazing in the community pasture. In other words, only through use of the community pasture developed on federally acquired lands, can John make the needed adjustments in his farm operations. This is especially true for John Adams and the other seven operators of submarginal farms in this segment of the project and is also true, but to a slightly lesser extent, for the seven operators of marginal farms.

It is estimated that when John gets this new farm plan into full operation, his annual net earnings from investment and management will be increased from the present minus \$66 to a plus \$617. He will be able to work at home full time, instead of away from home most of the time. Moreover, he will be building up his farm instead of allowing it to pass the stage of practical rehabilitation as it would soon if his present system of farming were continued.

Projecting such an adjustment as outlined for John Adams' farm to the other 22 farms in this segment of the project, it appears that the animal units for the 23 farms can be increased, through the project program, from 330 to 489; and the gross farm income can be increased from an estimated \$15,600 for the 23 farms to \$30,700, or 97 percent.

It will be realized that such a program as the one outlined here cannot be accomplished "overnight," or seldom in one or two years. Most of the ground work

may be done in two or three years depending on the availability of funds for land purchase and for conservation operations on the lands acquired. However, some phases of the adjustment, notably any needed changes in the type of farming by individual operators to remain in the area, must often evolve over a period of several years, depending on the abilities and resources of the various operators, and the use made by them of the credit and other assistance programs and facilities, local, State, and Federal.

Much progress has been made in this project, and individual farmers are recognizing the value of the program and cooperating in effecting it. At the same time, it must be recognized that such progress would be more adequate and rapid if there existed in the area an organization of farmers for cooperatively effectuating, with proper authority, the basic soil conservation and land-use adjustments in their own right and name.

The problems, and the handicaps in solving them, are being overcome to quite an extent by the excellent cooperation of the community which seems to recognize that its "bread and butter" is dependent upon the stabilization of its agricultural economy. Such stability is being effected through restoration of the "matchless grasses" that will again make the "Kingdom of Callaway" a "stock breeder's paradise" and keep its "imperishable soils" from perishing; that will bring back "the men of the grain fields" from "nowhere" to the security their families need, deserve, and can have by "sticking closely to the business" of stock raising

FACTS ABOUT CONSERVATION FARMING

(Continued from p. 269)

and grain systems of farming, the yield of corn that followed red clover sod in the rotation averaged 11 bushels more per acre than did corn following corn.

The Illinois State Agricultural Experiment Station found that one acre of untreated good Corn Belt land produced as much as 7 acres of the poorest untreated land for the period 1910 to 1938. These results were secured when appropriate rotations were used on both types of land, but no soil treatments were added.

These factual data are presented from different sections of the country to show that conservation farming, including proper land use supported by needed soil conservation measures, reduces runoff and erosion and insures immediate and continuing increases in crop yields. While increases of the same magnitude cannot be expected for all locations, nevertheless farmers who have applied conservation measures on their farms have experienced increases in crop yields.

SHORE EROSION ON THE CHESAPEAKE

By JOHN COTTON¹



Automobiles once crossed a small stream via this bridge which now is left standing in the Chesapeake Bay.



Shore where retaining wall is to be built. Old wall which was destroyed was about six feet from present shore line. Sea wall was constructed by the Harwood CCC camp under guidance of the Soil Conservation Service.

THE ever pounding action of waves has long played havoc with the banks along 3,600 miles of shore line on the Chesapeake Bay. There are places along the bay shore where tides surge unrestrained above sunken tombstones that once stood in family burial plots, places where the waves roll over the ruined remnants of foundations that once supported homes and barns. In one place along the southern extremities of the western shore a concrete bridge built for automobiles stands out in the bay—it once crossed a stream that outletted beyond it into the bay.

Farmers on lands adjoining the bay shore have for generations watched their banks give in to the fight against the waves. One dramatic symbol of the water's victory, off Tighlmans Island, is the brick lining of what was rather recently a fresh-water well now left standing out in the bay. Farmers owning much land along the shore front often lose as much as

an acre of land a year, or, as expressed by Walter Denny on Kent Island, "one turning row a year" (about 8 feet) along his whole bay front.

Families from urban areas close by, especially Baltimore and Washington, have found the bay shore an excellent vacation land especially for week-ends and have purchased waterfront property. Thousands have built summer homes. They, too, have found that each heavy storm takes another bite out of their land. The investment and improvements attached to these summer resort properties make the problem even more important, and more costly than the loss of agricultural lands.

Occasionally a hurricane sweeps up the coast. This ruthless invader can be counted on to rip out and wreck the shore line like a Panzer division smashing through infantry.

The famed oystermen, known the world over for their excellent sea food, complain of the erosion along these banks, not because of the soil covering their oyster beds, but because the muddy waters that lie over these beds do not permit a sufficient amount of light to trickle through to the oyster, or more important, to the microscopic organisms upon which it feeds. These poorly developed organisms or lack of organisms affect the normal growth of the oysters.

Countless attempts have been made to stop the washing by these waves. Some have reached a reasonable degree of success, not necessarily permanent, but at least to the extent of arresting the waves for several years. One of the most noticeable attempts to control shore erosion was carried out by the Harwood CCC Camp several years ago under the direction of the Soil Conservation Service. In this instance a sea

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wall 4 feet in height was constructed out of heavy planks for a distance of 1,000 feet along Deale's Beach. Eight-foot piling, 4 feet of which was driven into the ground with a home-made pile driver, was used for supports. The banks were then sloped to meet the wall at an approximate 4-1 slope. Today the wall is being used as a demonstration of a design approaching what appears to be the ideal, although it is considered by those most familiar with it that the height of the wall should be reduced to 3 feet, making it less expensive to construct and less vulnerable to the power of the waves. In addition, the banks probably should be sloped back at a little less grade, to prevent further damage by high waves.

It is upon the methods used by those who have been reasonably successful that the Soil Conservation Service and the University of Maryland have based some experiments, as well as upon improved recommendations. However, any recommendation or suggestion included in this article should not be thought of as being a permanent method, but one better than the usual method.

Sea walls.—One of the most common mistakes in building sea walls along the banks is failure to put in the footing at a sufficient depth below the point of low tide. This mistake is easily understood in that a great many of those building such a sea wall endeavor to locate the wall away from the waves—they place the structure next to the bank. In so doing, they do not take into consideration the slope of the beach, and as a result the wave action at low tide will often remove this beach between the wall and bay, leaving the footing exposed so that the sea wall soon topples into the bay.

In building a sea wall it is very important to figure the depth of the footing in relation to the low tide point, and not in regard to the depth in terms of dirt removed at the point where the wall is located.

Sea walls and vegetation.—Vegetative control methods in conjunction with structures have rarely been used. The general failure not to do this has made the usual sea wall more costly and much more vulnerable to the action of heavy waves. Vegetative erosion control offers elasticity that can not be duplicated mechanically, but of course it will not withstand constant wave action.

The more ideal sea wall design, as concluded in the study made along the bay front, is one that combines the sea wall with vegetative protection. In doing this the wall should be low, generally not more than 2½ feet in height on the Chesapeake Bay—just high enough to take care of the everyday wave action at

varying tides. The bank should then be sloped to meet the wall at a 6-1 slope or less. In this way the wall is backed up by the bank, has less surface exposed to the wave action during storms, and the high waves suspend themselves on the sloping bank above where the vegetation offers very little resistance to the wave but does hold the soil of the bank in place.

No vegetation could withstand such an action every day. But on the Chesapeake Bay where storms are not frequent and where the vegetation has opportunity to recover after such a pounding, this method of shore erosion control should prove to be stronger and generally much less costly.

This type of control of shore erosion generally requires maintenance following heavy storms. Where the vegetation is washed out or destroyed, it should be patched up so that the dirt behind the wall is always intact.

Many types of vegetation are good. Many of the bent grasses do as well in sand as any grass. Crabgrass also does well, although it does not offer much cover during the winter months. Bluegrass is as good as any if proper soil conditions prevail.

Bushes of any type found growing nearby likewise do well. Rose bushes lend themselves particularly well to such a purpose.

Vegetative practices.—Several attempts to stop bank losses by vegetative methods have been made by farmers owning long shore fronts where the lands are not of sufficient value to justify any very costly method of shore erosion control. Protection of the bank alone by vegetation in most cases does not work. The principle that should be adhered to in working with vegetative control is the building up or maintenance of a beach to suspend the wave action instead of allowing it to pound against the banks.

An interesting example of how a farmer followed this principle is seen on Tighlmans Island. By planting two rows of smooth cordgrass (*Spartina alterniflora*) in the sand, in clumps eighteen inches apart each way and at a good depth during low tide periods, this farmer established a good vegetative control practice. This grass can grow in water, withstands a brackish condition, and will spread. Through this method he has succeeded in building up a beach more than 300 feet in length and has extended it into the bay 10 or 15 feet in the past 10 or 11 years without any cash outlay, as the grass was transplanted from a nearby saltwater marsh.

This practice cannot be recommended generally, as similar attempts by other farmers in different localities have failed because their conditions were not so



Home-made shore erosion control by jetties, seawalls and piling; St. Marys County, Md.

favorable for establishment of the grass. The practice seems to work best when there is a gradual slope of the land in the bay away from the banks, making the water relatively shallow where the grass is planted. If such a planting is to be made, there should be three types of plantings, as outlined below, if the plants or grasses can be found close at hand and transplanted.

1. A planting in the bay itself at low tide. The only plant known now that will withstand this condition is *Spartina alterniflora*.

2. A planting along the beach, which may be any of the following:

Spartina cynosuroides (big cordgrass)
Strophostyles helvola (beach bean)
Spartina patens (salt meadow cordgrass)
Cynodon dactylon (Bermuda grass)
Festuca rubra (red fescue)
Panicum amarum and *P. amarulum*
Panicum virgatum (switchgrass)
Solidage sempervirens (beach golden rod)
 Local rushes and any other active material

3. A planting along the bank should be made to help establish and protect it, using any of the following:

Rosa wichuraiana (memorial rose)
Hemercallis fulva (day lily)
Lonicera japonica (Hall's honeysuckle)
Parthenocissus quinquefolia (Virginia creeper)

Any situation that tends to build up a beach by causing the sand to filter out, as in the vegetative control method, is desirable. Jetties are among the most effective methods of this type.

Increased emphasis on vegetation entering into the control of the shore erosion problem offers a real possibility toward solutions to many of the problems. To what extent vegetative control can be relied upon is still unknown; but it is certain that vegetative control methods used with or without mechanical structures materially reduce costs, and in the majority of instances when properly applied they increase the strength and the permanency of the control measure.

BIG-SCALE DEMONSTRATION OF PUTTING SOIL CONSERVATION ON THE LAND

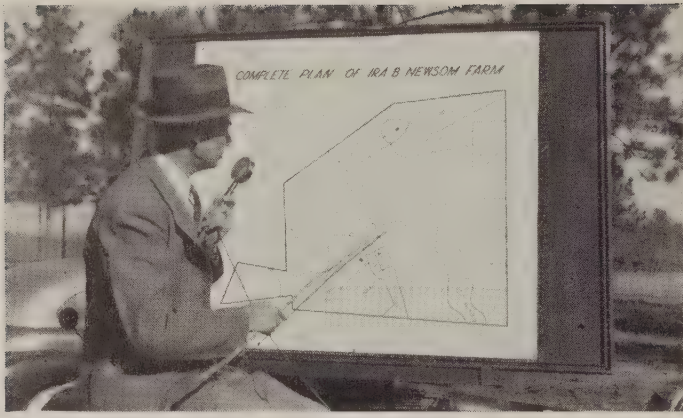
By ERNEST CARNES¹

HARRY W. Shealy's farm in the Lower Saluda Soil Conservation District in South Carolina was the scene, last November 5, of more different kinds of farming activity than usually can be found on the average farm in an entire year. More than 1,200 farmers tramped over the 225-acre farm during a one-day complete soil conservation demonstration designed to show every step in setting up a sound,

coordinated conservation program on the land. The demonstration on the Shealy farm was arranged especially for farmers in the Piedmont section.

A week later, on November 12, a similar demonstration was held on the Ira B. Newsom farm in the Lynches River Soil Conservation District for farmers in the Coastal Plain. Farms are larger in the Coastal Plain and farmers are fewer in a given area. But the 700 farmers who attended the latter demonstration

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At the beginning of the demonstrations farmers were told about the district conservation plans for the two farms and given an opportunity to ask questions. Here State Coordinator Ernest Carnes explains land use changes and soil conservation measures contemplated for the Newsom farm.

were no less outspoken in their opinion that the event was a big success.

"Let's all return to this farm next year on a convenient date to see the progress that has been made" was the comment not only of the district supervisors and representatives of cooperating agencies, but of the farmers themselves.

Automobiles loaded with farmers began arriving about 10 a. m. and groups of 50 to 100 were quickly formed, each with a designated leader from one of the cooperating agencies. As each group was organized, a speaker on a sound truck explained the farm plan with the aid of a large map and the trek over the farm began.

Representatives of the South Carolina Agricultural Extension Service, the South Carolina Commission of Forestry, and the Soil Conservation Service, who cooperated with the supervisors in arranging the program, were stationed at each demonstration point and led the discussion as groups moved over the farm with clocklike regularity.

Special emphasis was placed on the food for freedom angle of a district farm plan with demonstrations of such practices as pasture improvement, establishment of annual and perennial grazing and hay crops, development of a farm fish pond and an irrigation system for the farm garden. Extension specialists led discussions on construction of a milk cooling box for the farm well, a drinking trough for the pasture, a box silo, hay-curing rack, and potato hack.

On cultivated fields, the demonstrations included setting up sound rotations, strip cropping, construction of terraces, establishment of meadow outlets; also, development of border strips for wildlife between fields and woodland by releasing native shrubs at the edge of the woods and seeding a strip of sericea lespedeza adjacent to the cultivated land.

Woodland phases of the program were discussed and demonstrated by forestry representatives of the cooperating agencies. These included the development of fire lanes, tree planting, thinning, and methods of cutting and selling mature timber to the best advantage. The foresters also gave demonstrations of fence-post treatment.

Much of the success of the demonstrations was due to excellent planning. Technical committees of the various agencies assisted the district workers in developing a farm plan for each of the two farms. Enrollees from the Newberry and Goldville CCC camps spent several weeks carrying out the preliminary work on pastures, fields, and woodland, but leaving the final completion of the work until the day of the demonstration.

County agents, vocational teachers, FSA supervisors, and other local agricultural leaders took an active part in setting up groups of farmers and vocational students from surrounding counties and arranging transportation to the demonstration. Newspapers and radio stations cooperated in carrying advance stories and radio programs through arrangement made by Extension Editor A. B. Bryan.

Governor Burnet R. Maybank, taking cognizance of the importance of the soil conservation district program in the State, proclaimed the week of November 3-8 as South Carolina Soil Conservation Week, calling special attention in his proclamation to the two soil conservation demonstrations.

"This type of demonstration where farmers can see for themselves in a single day a variety of sound soil conservation measures being established on the farm should help tremendously in facilitating the work of the soil conservation districts," said E. C. McArthur of Gaffney, S. C.

Mr. McArthur is a supervisor of the Broad River Soil Conservation District and president of the South Carolina Association of Soil Conservation District Supervisors. He continued, mentioning specific prac-



After observing one soil conservation practice the farmers were escorted in groups to the scene of another practice until they had seen all the practices. Here a group is looking at the newly established strip cropping pattern on the Newsom farm.

tices, "I also feel that the districts, through such demonstrations, can be of greater help to the food for freedom program. Pasture improvement work, the establishment of meadow strips, and greater use of perennials such as kudzu and sericea lespedeza as a permanent source of hay, which were demonstrated on the two farms, are among the conservation measures that will play an important role in helping farmers to produce more food for our war needs. These conservation measures not only do an excellent job of preventing erosion but also enable the farmer to produce feed for livestock at a low cost, and often on land that is not suited for other crops."

Ordinarily a farmer has difficulty in visualizing a complete conservation program, because even on his own farm it takes several years to change over from the ordinary one-crop system to the new plan of conservation farming. But in the two demonstrations held last fall, South Carolina farmers had an opportunity to see the complete transformation within a single day.

Nearly 2,000 farmers returned home after the two demonstrations with a new conception of conservation farming which otherwise might have taken them years to attain. And district supervisors and agricultural workers alike were agreed that in these two 1-day programs they had hit on a plan that will really



Home-built milk cooling unit using water pumped from deep well, Shealey farm. The milk cans are placed in the barrel, the water turned on, the milk quickly cooled.

speed the development of conservation on the land.

The demonstration was equally impressive as an indication of what district conservation farm plans can do to help meet requirements of the food for freedom program. As a result of land-use changes made in carrying out the conservation plans on the two farms, perennial hay and improved pasture acreage was increased sufficiently to double the number of dairy cows on the two farms.

UTILIZATION OF RANGE PLANTS ON WYOMING WINTER SHEEP RANGES

By KENNETH FIERO¹

SINCE the great drought of 1934, which forced the unprofitable sale of approximately 50 percent of the livestock on the Great Plains, the people of the range areas have been vitally interested in knowing more about their grazing resources and means to maintain them. They wish to know more about the behavior, peculiarities and economic value of plants, methods used to appraise range conditions, and how to judge proper utilization of range plants. This information is necessary for the management of the resources of the western range lands—resources that supply feed for 16 or 17 million animal units each year on the ranges west of the 100th meridian.

Now, with war time demand upon ranges, it behooves conservation agencies and the livestock producers to give greater attention to local conditions, including climate, soil, slope, past use, plant com-

position, density, etc. One of the principal activities of the Soil Conservation Service in the western United States has to do with helping ranchers improve their range management practices. It is a task that requires use of all available information, and further study, to ensure adaptability of plans to local conditions. This article tells briefly the method we are using to study range utilization in one Wyoming area, a 45,000-acre winter sheep range near Riverton.

Inasmuch as range forage is an annual crop, principally from perennial grasses, its yield can be estimated within reasonable limits by plant growth specialists; but the ranchman needs information concerning the degree to which different forage plants are used by livestock to help him determine the weak points in his range management practices. On winter ranges, a forage inventory, taken before grazing starts, shows the range man how much native forage he has on hand

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so that he can pace his operations accordingly. An inventory at the close of the season will indicate whether sufficient plant material is left to maintain plant vigor and conserve soil and moisture, and will also give information on the utilization of different forage plants which may point the way for management changes from time to time.

The proper degree of use that may be safely practiced on the dry browse ranges of the Red Desert of Wyoming, where precipitation is scanty and the poor soils thin and salty, is decidedly different from proper use on the better watered ranges on the glacial till in North Dakota or of the well-grassed ranges in the sandhills. Data obtained in a three-year utilization study on a 45,000-acre winter sheep range east of the Big Wind River, near Riverton, Wyo., have shown the desirability of localizing range information, and thrown new light on the use of some forage plants by sheep in winter on this particular type of dry browse range. The terrain of this purely winter sheep range unit is undulating; elevations range from 5,200 to 5,400 feet. Drainages are intermittent and flow north to the Big Wind River, and the soils are thin, immature residual developments from Tertiary sediments which support a modified mixed prairie association with intermingling shrubby plant communities.

Range operations are conducted according to a management plan prepared after a range survey delineating forage types and showing type acreages, plant composition, forage density and estimated capacities, locations of water, fences, bedgrounds and salting stations, and other pertinent information. In this range study, the volume production rating of each key species of forage plant was determined prior to grazing in the fall, by clipping, sorting and weighing the vegetation from sample plots of 100 square feet each. The same procedure was used in the spring after the stock was removed to ascertain the amounts of forage used from each key species.

Records of actual use of the range, obtained from camp movers and herders who cared for the sheep, included information on the actual number of animals grazed, number of days each bedground was used, and

the approximate area grazed from each camp site. Five nights at a bedground was the maximum recommended in the management plan and was exceeded only when severe winter storms compelled it. The following table gives the record of grazing use, and the illustration accompanying this article is a small segment of the range map showing the operation of the management plan and the percentages of utilization of each important forage species.

Numbers of sheep were adjusted in accordance with the variations in the available amounts of forage resulting from year-to-year differences in the amounts and distribution of rainfall. Thus, only 70 percent as many sheep were grazed the second season as during the first, and in the third season only 77 percent as many sheep were grazed as during the first season. The general condition of the range at the end of the evaluation was somewhat better than it was at the start.

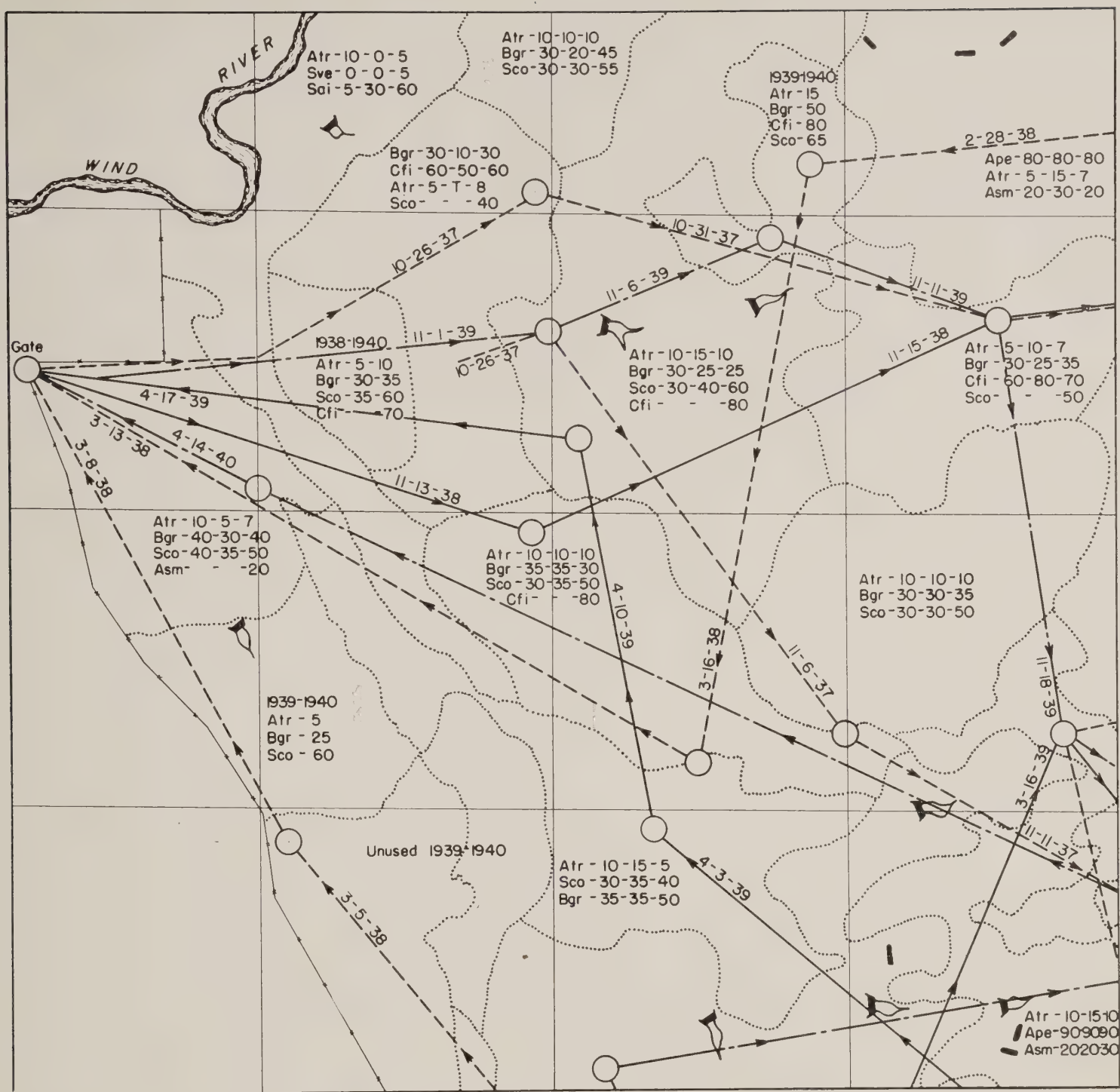
The range survey, and the utilization and forage production measurements of key species point the way to specific recommendations for this range.

Brown sage (*Artemisia pedatifida*), which is a dwarf sagebrush confined largely to small saline areas, and threadleaf sedge (*Carex filifolia*), a grasslike plant commonly referred to as "niggerwool," were preferred by the sheep and appeared capable of maintaining themselves under heavy winter use. On the other hand, the sheep utilized blue grama (*Bouteloua gracilis*) and western wheatgrass (*Agropyron smithii*) far less than expected, although the former, because of its quantity, still is the major forage resource on this range.

Big sagebrush (*Artemisia tridentata*), is the most widespread. It furnished 37 percent of the ground cover but produced less forage—37.4 grams per square foot of ground cover—than any of the other species measured. In addition to its low yield, the quality of forage from big sagebrush is low. Only 10 percent of the annual growth of this species was grazed; this is one-half the amount provided for by the "proper use factors." Brown sage, the least plentiful, furnished only 4 percent of the ground cover but was utilized

Year	Stock entered	Date of arrival	Date of departure	Stock removed	Death loss	Total sheep months
1937-38	4,000 ewes..... 145 rams.....	Oct. 26, 1937 Dec. 5, 1937	Mar. 13, 1938 Jan. 14, 1938	3,945 ewes..... 145 rams.....	55 ewes.....	18,166
1938-39	2,229 ewes..... 88 rams..... 200 antelope*	Nov. 13, 1938 Dec. 7, 1938 Dec. 15, 1938	Apr. 17, 1939 Jan. 15, 1939 do.....	2,199 ewes..... 88 rams..... 200 antelope.....	30 ewes.....	11,455
1939-40	2,400 ewes..... 80 rams.....	Nov. 1, 1939 Dec. 10, 1939	Apr. 15, 1940 Jan. 15, 1940	2,350 ewes..... 80 rams.....	50 ewes.....	13,306

* Number of antelope and period of use only approximated.



Common Name Of Plant	Symbol	Percent Utilization By Years		
		1938	1939	1940
Big Sagebrush	Atr	5	10	15
Thread-Leaf Sedge	Cfi	50	60	10
Blue Grama	Bgr	30	25	20
Needle-And-Thread	Sco	30	30	55
Grease Wood	Sue	0	0	5
Alkali Dropseed	Sai	5	10	15
Western Wheatgrass	Asm	20	25	25
Brown Sage	Ape	90	90	90

LEGEND

Stock Water And Erosion Control Dam 
 Camp Or Bedgrounds (Salting) 
 Route Followed 1937 - 1938 
 Route Followed 1938 - 1939 
 Route Followed 1939 - 1940 
 Water Spreading Dike 
 Type Lines 

Segment of range management map of winter sheep range near Riverton, Wyo. It illustrates the way forage types and plan of use were outlined for the benefit of the range user.

to the extent of 80 percent of its annual growth, as compared with a tentative "proper use factor" of 10 percent.

Needle-and-thread grass (*Stipa comata*) furnished the largest amount of feed per square foot of all the species measured, and 45 percent utilization of its annual growth is above the general "proper use factor" of 40 percent. This grass produced forage at the rate of 104.4 grams per square foot of ground cover, a third more than the next largest producer, western wheatgrass. Even though it furnished but 7 percent of the ground cover, it was second only to blue grama in the amount of feed it furnished to the sheep.

Threadleaf sedge, in spite of 65 percent utilization of its annual growth, ranked only ahead of big sagebrush in the volume of feed it furnished the sheep—this, primarily, because it provides only 6 percent of the ground cover. Its production rating is 57.8 grams per square foot. The general "proper use factor" for this species is 70 percent utilization, slightly above the actual use on this range.

Probably the biggest surprises were the utilization figures on blue grama and western wheatgrass, which had been accorded "proper use factors" of 70 and 50 percent utilization, respectively. Blue grama had a production rating of 43.8 grams per square foot and 26 percent actual utilization of its annual growth, and it is only because this species furnished 27 percent of the ground cover that it topped needle-and-thread grass in the amount of feed provided for the sheep. Western wheatgrass, with an actual use of 25 percent of its annual growth—almost equal to blue grama—had a production rating of 75.4 grams per square foot, but it furnished only 11 percent of the ground cover.

For this range—and presumably for other ranges

with like rainfall, soils, and other conditions—the "proper use factors" need to be revised upward for two key species, brown sage and needle-and-thread grass. Downward revision is needed in the case of big sagebrush, threadleaf sedge, blue grama and western wheatgrass.

Because of the low quantity and quality of feed it produces, it is evident that high densities of big sagebrush are not desirable even on such a browse range as this. Small amounts are desirable, however, to give variety to the forage, and in time of deep snow big sagebrush may be the only feed accessible to the stock. The high productivity and high utilization of needle-and-thread grass indicate that some increase in this species is desirable at the expense of big sagebrush and blue grama. Since western wheatgrass was utilized equally as well as blue grama and produces half again as much forage, it, too, can take over profitably a part of the area occupied by blue grama and big sagebrush.

These illustrations emphasize the need for close observation of the use made of the important forage plants by livestock. A plan of management designed to encourage or perpetuate the better forage plants will be successful only if based on such use data under actual range conditions.

The results obtained here in localizing range information for the guidance of stockmen should impel range men generally to look into the effects of local variables on the utilization of range forage on other types of range lands. It is likely that there are opportunities for increasing forage production which heretofore have been overlooked, opportunities important to the livestock industry in general and to war production goals in particular.

HUMAN CONSERVATION IN NORTHERN WISCONSIN

ON Monday, September 8, 1941, I drove with M. F. Schweers, State Coordinator, to Antigo, Langlade County, Wis. With County Agent John Omernick, we spent the day reviewing the isolated settler program in that county.

The soils of Langlade County are of two general classes. The more level lands in the southwestern part are old lake beds and older drift of fair soil which, with the addition of limestone and fertilizer, produces good crops. The remainder of the county consists of morainic soils of sand and rock with some good soil

scattered here and there. The zoned areas with their isolated settlers are generally in this latter section. As the settlers are removed, those who wish to continue farming are located in the lake bed soils area. Many of the tracts in the morainic area which may be fair soil are known as "frozen areas." That is, these places suffer from early summer and early fall freezes, making crops such as corn and potatoes too uncertain. These poorer soils produce good pine tree growth. We saw one area of Norway pine, 15 years old, that were 10 inches in diameter at the base and 25 feet

The observations presented here are from a report by F. A. Fisher, Chief, Project Plans Division, Upper Mississippi region, Soil Conservation Service, after a field review of the Wisconsin Isolated Settler project activities. In connection with this project the Soil Conservation Service is buying holdings of isolated settlers within districts zoned against further agricultural development. These settlers, because of their isolated locations, present social problems as well as problems of high costs for public services and facilities to local and State governments. By cooperation between local, State, and Federal agencies, families whose holdings are acquired are helped in becoming established in new locations where public services and facilities can be provided at a more reasonable cost and where the families may participate in community life and have a better chance of making a living. The Wisconsin Isolated Settler project was approved by the Secretary of Agriculture on September 19, 1938, and covers twenty-four northern Wisconsin counties. Since 1934, the holdings of about 375 isolated families have been acquired in connection with this and similar projects in northern Wisconsin. Most of the families have been relocated. In his report, a part of which is reproduced here, Mr. Fisher points out features and merits of this joint program of local, State, and Federal action which are frequently overlooked.—THE EDITOR.

high—a better growth than can be expected on the average soils in this area.

As we drove and talked, we began to realize that the success of the isolated settler relocation program depended to a great extent on the interest taken in it by the zoning committee and the county agent. Again I was impressed by the fact that the isolated settlers are like any other people in that they have justifiable rights to their ideas, and success in getting them to move depends on good diplomatic relations with them. Making them feel that the final decision is theirs and not forced upon them by law, helping them in relocating, and displaying a keen interest in assisting them after they have moved—these are factors that help greatly. Mr. Omernick illustrated this by stories of instances where he had followed through and helped families to better their agricultural or nonagricultural positions. In this connection, too, we visited several of these people, and they had many questions to ask regarding soil treatments, livestock improvement, poultry management, pasture development, and conservation practices.

In going over the map showing tracts purchased and families relocated, the fact was brought out that, for approximately every farm purchased by Federal funds, the county exchanged lands with two others. It was further pointed out that in dealing with a small group of families using one road or school, unless funds were available to purchase the holdings of those who insisted on selling out, it would do no good to exchange with the others. The road or school problem would still remain. Therefore, the Federal and county programs must go hand in hand.

Mr. Omernick also stated that not over 10 percent of

the isolated settlers ever were real farmers or had any desire to remain farmers. Four whom we visited were railroad shop workers from Chicago and Savanna, Ill., who were discharged during the depression. They had saved some money and, through land companies, had bought tracts in this area, "sight unseen."

Naturally an outsider who has never really studied the isolated settler conditions and the results obtained from the relocation work is inclined to measure the benefits in financial savings through the closing of schools, shortening of school bus routes, and discontinuing of roads. As he delves into the situation, however, by talking to people who have been moved out, and listens to stories from those in charge of the project, he finds that these are not the real values. The results that count are such intangible ones as removing these people from isolated locations and renewing their hope in America, their pride in their country, and giving them opportunities for community and social life with the advantages of better schools and recreational facilities for their children. The children have a chance to compete in 4-H Clubs and join Boy and Girl Scout troops. Religion is brought to both young and old through the churches of the community. Many of the men who have been located on good roads have found work and are thus taken off WPA and relief loads. Because of the distance these people live from the main roads, the county had quite a heavy expense for medical attention.

A few specific examples will point out more clearly what I mean by the intangible results of the isolated settler project in Wisconsin:

No. 1.—This family was moved to an attractive little home on a tract of a few acres. The head of the

family has work and is off relief. The children can go to a good school and the entire family is taking a part in the community life. Moving this family permitted closing a stretch of road and eliminated the necessity of rebuilding one good-sized bridge that would not have served any other settlers.

No. 2.—This family, with two children, has been located in a comfortable house near the highway. The father has a job on the highway. Before they were moved, they lived on a fire lane and the children could not go to school. Relocation has provided this family with a regular income and given them an opportunity to take their place in community affairs.

No. 3.—This settler was moved near the highway. He has a log cabin home and with a filling station and a few small cabins for tourists is making a living.

Nos. 4, 5, and 6.—The location of these families is similar to No. 3. Moving these families allowed the closing of one school and several miles of road. It also made possible retirement from cultivation of a fair-sized block of land, most of which has been reset to timber. The story of the soil is that it produced two crops and then was so poor that not enough could be raised on it to pay the operating expenses.

No. 7.—This family was relocated in a community where the man has fairly steady work which, with the income from his small acreage, furnishes a living for them. He has developed an interest in the community and the children are taking part in school and other affairs.

No. 8.—This individual was so far from any main roads it created a heavy county expense to care for him. He now has a small place on a main highway and is making a good living with his cow, chickens, and some bees and a roadside market of honey, maple syrup, and a few other articles. He has joined the local Grange and is very active.

No. 9.—The individual who bought this place proceeded to build a large, well-equipped dairy barn and other buildings before he realized he only had a few acres on his 80-acre farm that were suitable for cultivation. The farming project failed, the buildings deteriorated, and the owner was only too glad to sell for what he could get on a fair appraisal. The family left the community, feeling very much put out at a Government (although no Federal agency was ever consulted) that would allow people to be caught in such a deal.

No. 10.—We visited a farm which cost the original purchaser \$1,800 and has since cost the county \$2,500 for school and roads, besides relief to the individuals. Two families who were living there have been removed

and are supporting themselves. Most of the land has been planted to trees by the CCC. Here we saw an illustration of diplomatic dealings with these people. Under permit, they are salvaging old buildings and cutting some trees on county-owned land for a barn on the new place. Mr. Omernick indicated that such assistance helps to keep peace and to have satisfied people. They will repay many times in helping to enforce the laws. He further indicated that, in his opinion, the greatest contribution of the rehabilitation work in Langlade County is the chance these people are given to make their own way and thus become good citizens with the opportunities of America for them and their children.

After lunch, we visited Mr. A—— who came to this country while in his teens. He worked in a railroad shop in Illinois until 1932 when the shop was closed. Through a land company, he bought 40 acres and moved on it with great hopes. He built a small house and barn but found only about four acres that he could farm, the rest being scrub timber and swamp. He struggled along until his savings of \$1,500 were gone. He said he was gradually becoming doubtful about our form of Government, which, after what he

(Continued on p. 288)

HILL CULTURE FOR NATIONAL DEFENSE

(Continued from p. 272)

of one holly tree which would produce a cash crop of \$25 value every year, yet not be injured in the least by the trimming.

These, and other things like them, are "hill culture." They are not, for the most part, new things, but rather a re-use, or a greater use, of resources we already have; of crafts and practices known to our forefathers. In some instances science has stepped in to give us better methods or to provide us with better tools—otherwise "hill culture" remains as native as ginseng and ramps.

The end of such a program is not to be seen in a day, or even in the present emergency. It is not so designed. After the emergencies of war we shall be faced with the less exciting, and often more acute, readjustments to a peacetime world. No one can tell what such a time will hold for us; but this we know—there will always be need for food, and if this can be produced at home, so much the better. No person imagines a time when a cash crop, even of small return, will be unimportant on our hill farms. "Hill culture" will do its bit in our national wartime program—it will hold and enrich our soil, and it will be in operation when we turn to the ways of peace.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

OLD McDONALD HAD A FARM. By Angus McDonald. Houghton Mifflin, Boston. March 1942.

This is the book that "had to be written." The author, who works for the Soil Conservation Service—we call him Angus—carried this particular bit of Americana about in his head for more than five years, mulling over it, being "pestered" by it, wondering why he "had to do it." Now the story of one Oklahoma farm has become a book and the Old Man, Angus' father, an unforgettable character. The Old Man was "like the hills, the sky, or the soil that he loved so much"; he preached the Gospel on Sundays to save the souls of his neighbors, and on weekdays he worked like a horse, building up his own land and roaring at his neighbors about wasteful exploitation of Oklahoma's soil.

"This is God's earth, and you are sinning and desecrating His land when you plow up and down the hill," Old McDonald said. And although he did not know it he set the theme for this biographical story, and at the same time stalked his way across the fields of his "hill farm" to take his place in the rank and file of pioneer conservationists.

VICTORY GARDENS, *Miscellaneous Publication No. 483*; and **Diseases and Insects of Garden Vegetables**, *Farmers' Bulletin No. 1371*. United States Department of Agriculture, Washington, D. C.

If you have a big flourishing vegetable garden next summer, with some fruit trees and berry bushes, you will not need to worry about shortages. The fruits and berries probably are sugar-sufficient for good health; and you will be so busy keeping the garden "flowing along" with the subseasons that, tires or no tires, there will be little or no time for joy-riding. These two business-like bulletins, totaling 60 pages, can be stapled together and hung on the wall of the tool house to be used along with other gardening implements. In fact, they should come first, because they contain much valuable information concerning disease-free varieties and soil preparation for the healthy garden.

"Victory Gardens," compiled for wartime gardening by Bureau of Plant Industry specialists, is a garden outline showing, first, the vitamin and mineral values of the common garden vegetables; second, how to prepare and fertilize the soil and arrange the planting time-table for continuous harvests; and, third, how to mulch and cultivate to keep the soil in place and in good condition throughout the seasons. Three garden plans are shown in chart form, and these include spacing directions, suggestions for varieties and follow-up plantings, and the amount of seed needed for each row.

An insect or disease infested garden is not a productive garden, as all experienced gardeners know; and, furthermore, it is probably the most discouraging thing that can happen to the people who have reached the liniment-for-sore-muscles stage and find themselves up against an inadequate knowledge of the ways of bugs and slugs, and the bacteria and fungi that are the mortal enemies of garden crops. "Diseases and Insects of Garden Vegetables" is an old standby that has been used by many thousands of vegetable crop growers for the past 15 years. It is, of course, a Bureau of Ento-

mology publication, and it has been kept up to date by revisions so that it becomes in the present emergency one of the most valuable and practical of government bulletins. It is, in fact, a rather extensive treatment of "garden troubles." The writing and organization both are admirable—the language is direct and without frills, and pests are arranged under specific garden crops. If you find a strange insect on your tomato vines, for instance, you need not know the name of the crawler because you will find him—and his portrait—under "tomato." You will also find what to do about the insect (or disease), and what you could have done to prevent the infestation had you thought about such things before you plowed your garden plot and purchased your seed!

The last few pages of *Diseases and Insects of Garden Vegetables* is devoted to fungicides and insecticides—how to mix them and how to apply them. Some miscellaneous control methods are treated briefly, as soil disinfection, seed fumigants, and protection of beneficial insects.

SOILS AND FERTILIZERS, 3rd edition. By Firman E. Bear. John Wiley & Sons, New York and London. January 1942.

After reading this book and studying its organization, one comes to the conclusion that farming—using the soils and the seeds of the world to produce the crops required by the people of the world—is the most complicated business ever conceived. In America, now that war with its stupendous production is upon us, we need to work fast to learn the fine points of building up poor soils as well as keeping all soils in place by means of erosion-control practices. Judging from Dr. Bear's carefully compiled book, there is much to know about the soil itself, the food and textile crop plants so badly needed, and the many different kinds of fertilizing agents before going out to buy commercial fertilizers or even before spreading manure on a field with the fond hope of producing a bumper crop for "quick money." This is the first text of its kind to correlate with precision the climatic factor, soil conservation practices, and problems of choosing and applying chemical and mineral fertilizers for greatly increased yields of a wide variety of crops.

Today fertilizers are very much in the news. Do not waste fertilizers—you see and hear these words everywhere. It is one of our most urgent problems in the food for freedom program. We must not fail in the wartime food production goal and we must guard our soils while growing and harvesting much larger crops of certain food plants. If every pound of fertilizer that we can get our hands on is used where it is needed, without waste, then the production goal will move many steps nearer during the planting and growing season. Dr. Bear must have been thinking along these lines when he went about the task of revising and augmenting his material and getting out this 1942 edition under a new title.

The book is designed as a text for agricultural colleges and, perhaps unfortunately in view of the war time emergency, it is a bit too technical for general farmer use. But soil fertility specialists or farmers familiar with chemical terms and symbols, can use it to advantage to obtain a more workable understanding of ways and means of handling soils and crops for maximum fertility and pro-



BOOK REVIEWS AND ABSTRACTS

continued

duction without loss of soil resources or waste of fertilizer materials.

The careful attention to specific crops is one of the book's best features; by this means the explanations of soil phenomena, water and atmospheric conditions, and the action of fertilizing agents are closely tied in with crop requirements. Even lime, used so widely through so many generations of farmers everywhere, is not to be thrown about promiscuously, without knowledge of soils and soil reactions, or without a wary eye on the weather and moisture conditions—certainly not while wartime production is paramount. This principle, applied to the true fertilizers, especially the expensive or scarce mixtures, should help greatly in saving the day for agriculture during the period of high production.

Apparently Dr. Bear believes first in saving the soil, keeping the soil in place, and second in maintaining its fertility by means of fertilizer applications. Thus he does not devote a single chapter to soil conserving practices and then forget all about them in presenting the tried and proved principles of fertilizer usage. What he does is incorporate soil conservation and soil properties, crop growth requirements, and selection and application of fertilizers into a soil management plan for permanent agriculture. He explains as he goes: for example, you will find an explanation of effective mulches in a chapter headed "The Water in Soils."

The latter half of the 375-page volume is devoted to fertilizing agents: how to determine soil deficiencies by means of plant symptoms; how to choose the right fertilizer for the crop, the soil, the water supply, the cultivation practices, the kind of yield expected; how to apply the fertilizer and when; and, best of all, how to utilize every pound of fertilizer elements produced on the farm as by-product or as waste—ashes, lawn clippings and leaves, kitchen and barn refuse, sawdust, even sour milk.

Finally, it may be said that this unusually complete treatment of soils and fertilizers is compiled wholly from the viewpoint of farm and crop production economy—a very excellent feature especially in view of wartime needs and the fact that many a farmer will lack commercial fertilizers during the next few years, be his pocketbook thick or thin. The more you pore over the book the more you realize that Dr. Bear has thought of everything: every chapter ends with a "solution" or a "résumé" section suggesting ways and means of getting around shortages, of shifting the crop to fit the need for economy, how to side-step losses, and many other small economies that in the aggregate constitute tremendous gains.

WATCH YOUR STEP. Miscellaneous Publication No. 481, United States Department of Agriculture in cooperation with the Committee on Agricultural Safety, Federal Interdepartmental Safety Council. Prepared by Wellington Brink. Washington, D. C. February 1942.

This handy-sized bulletin already has gone a long way around the country in the attempt to head off farm accidents—at all times, but especially in this year of hurried and heavy work, scarcity of farm labor, and the tension of wartime production. In a recent, more normal year, 300,000 farm people were seriously injured by accidents, most of them preventable—on United States farms. Thou-

sands die each year from accidents that could be prevented. These people are Americans, and their farms are American farms; all are essential to American life and effort. Most accidents can be avoided—hence this bulletin, now being widely distributed, which was compiled by men who have made a thorough study of the causes behind such farm catastrophes.

Watch Your Step is rather a different kind of Government bulletin—it has a snap to it, and a strain of humor, and it points out what to do and what not to do to prevent accidents and property loss on the farm, in and about the home, on the highway and in rural recreational activities. "Homey" everyday things are its theme. Saws, cisterns and pits, motor machinery, ladders, rotten railings, matches in the hands of little children, the farmer mending the roof, the stovepipe too near the woodwork, the worn electrical cord, wash day, the hayloft and the cigarette, the child playing on the highway—these are some of the hazards that can be easily and quickly removed.

This new bulletin is for farm people—available, free while the supply lasts, from the United States Department of Agriculture, Washington, D. C.

HUMAN CONSERVATION IN WISCONSIN

(Continued from p. 286)

had gone through, was not hard to do. Then he was induced by the County Zoning Committee to sell his farm and buy another tract of better land. The FSA loaned him \$1,600 for a barn and livestock. He moved the house from his former place, and although it isn't much of a place, it is comfortable. He has a good barn, two well-built hen houses, some machinery, 10 cows and some young stock. He owns 80 acres of land, all paid for, and has paid \$1,200 on his development loan. He could pay the remainder but is taking care of the payments as they come due and using the money for further improvements. In cooperation with the FSA he keeps accurate records of his farm. His herd averaged about 260 pounds of butterfat last year and his hens cleared over \$200 above feed costs. Above all, his doubts about our form of Government are gone; he is proud of the opportunities our country has given him.

Later, we visited the farms of three brothers who had all worked in Chicago and then been caught in the land speculation. They, too, had given up much of their hope and faith in America; but today through the help of Federal agencies, each has a good farm and is doing well. While questioning the son of one of these men, we were told, "Yes, I can go to high school now and I want to go on to college and study agriculture."

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit

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¹ Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

² From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

The Facts About Conservation Farming and Yields

BY R. E. UHLAND¹



THE PRESENT WAR is calling for increased production of many important crops and will therefore demand the assistance of all those engaged in agricultural pursuits. More than ever before, any recommended soil conservation measure will need to be evaluated on the basis of its effect on production or yield as well as its effectiveness in conserving soil and water. Costly mistakes in the unwise use of farm land during and following the last war must not be repeated.

Farmers have never been as concerned about data on saving the topsoil as about greater yields from land on which conservation measures are used. Partly for this reason extensive evaluation studies and field tests have been carried out over a period of years on many soil conservation projects. These studies greatly supplement the data secured on conservation experiment stations and furnish factual field data on the effects of conservation practices on yields.

The findings reported in this article show that conservation farming, including proper land use and supported by needed soil conservation measures, insures immediate and continuing increases in crop yields. These data are taken from different sections of the country and are quite indicative of results that can be expected from conservation farming.

In the Estancia Valley of New Mexico, where rainfall is limited, contour farming supported by terraces yielded 47.3 percent more beans for the 4-year period, 1936 to 1939, than did similar fields that were unterraced and farmed in straight rows. Thirty-four unterraced fields with straight rows were compared with 22 similar fields that were terraced and contoured. The difference in favor of the treatment ranged from a minimum of 12.1 percent in 1936 to a maximum of 82.3 percent in 1939.

Similarly, in 1939 wheat yields on nearly 200 fields in the Southern Great Plains were 31.3 percent greater where the land was terraced and contoured. The average yield for the terraced and contoured fields was 16.8 bushels per acre as compared with but 12.6 bushels where the land was farmed in straight rows without regard to contour. On two of the 7 projects on which yields were taken, the rainfall was above average and well distributed, and thus there was little difference in yield between the treated and untreated fields. Yields taken on a limited number of fields in 1940 showed similar increases for the treated fields.

(Continued inside on page 266)



¹ Liaison officer, Research-Operations, Soil Conservation Service, Washington, D. C.

June 1942

THE FLAG IS
ON THE PLOW



S OIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Food and feed are on the make. The bounty to fill the ships is on the assembly lines of the American farm. Agriculture is at war not only against the Axis but against insects, weeds, drought, disease, and soil waste. *Crop Husbandry in This Year of War*, leading article in this issue, is timely and pertinent reading.

UNITED STATES DEPARTMENT OF AGRICULTURE - WASHINGTON

CONTENTS

Crop Husbandry in This Year of War:	Page
By C. R. Enlow.....	289
The Flag Is on the Plow:	
By W. C. Lowdermilk.....	292
War Production and the Technician:	
By William T. Angle.....	294
Growing Soybeans With Minimum Erosion:	
By Dwight D. Smith.....	295
Wind Erosion in the Pampas of Argentina:	
By Manfredo A. L. Reichart.....	298
Neighborhood Action:	
By Ivan McKeever.....	301
Osage-Orange Plantings:	
By Charles F. McGraw and Joe B. Davidson.....	303
Book Reviews and Abstracts:	
By Phoebe O'Neill Faris.....	304
For Reference:	
Compiled by Etta G. Rogers.....	Opposite 304

Front Cover by Bernard L. Simmons

Back Cover by Katharine R. Johnson

WELLINGTON BRINK
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SOIL CONSERVATION

CLAUDE R. WICKARD
Secretary of Agriculture

HUGH H. BENNETT
Chief, Soil Conservation Service

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CROP HUSBANDRY IN THIS YEAR OF WAR

By C. R. ENLOW¹

EVERYONE is aware of the effort that is being expended to increase rather sharply the production of crops and livestock. Corn goals are set at 10 percent over 1941, soybeans 54 percent, flax 34 percent, and sugar crops to the limit of processing facilities. The production of many other field crops, vegetables, and fruits will be increased. Hog marketings in 1942 are estimated at 20 percent higher than in 1941; in fact, all livestock and livestock products are being pushed.

All agricultural agencies are working together to assist farmers in planning for this necessary expansion of the farm business throughout the country. Extraordinary efforts have been put forth to see that the increased acreage is in those areas where high production can be expected with minimum disturbance to the general farming program, and with the least damage to the soil. However, with such an increase in crop acreage to be planned and initiated within a few months, all of us must realize that many complications will arise. There is a shortage of farm labor and farming machinery. There is less opportunity to control soil erosion and fight the usual crop enemies, insects, and disease. Control of weeds, so important at all times, is particularly important during this cropping season. It is unfortunate that farmers must face this increased production program with its many problems when they are handicapped through lack of labor and inability to obtain much needed equipment; but it is a challenge that will be met by all farmers who realize that their crops are essential to win the war.

It has been pointed out by an agricultural authority that the danger of plant-disease epidemics and insect infestation is acute at this time because of the increased crop acreage on the farm. Farmers will have less time

to combat crop enemies because of the heavy work load and shortage of farm labor. As this is written, early in April, the green bug is reported to have wiped out 60 percent of the oat crop in north Texas, and warnings have been sent out in Oklahoma and Kansas so that farmers will be prepared to plant catch crops if the green bug destroys oats, barley, wheat, and forage crops. There is no practical control measure for the green bug in large infestations of this kind.

After a crop has been planted, the yield depends to a large extent on the efforts put forth by the farmer to keep it in good growing condition. Tillage is of particular importance from the standpoint of weed control. Weeds are heavy users of moisture and plant food and if allowed to grow, they will take a large share of the plant food and water that should go to the growing crop. Timely and proper tillage means a great deal in obtaining excellent yields of row crops. It was proved years ago that the main purpose of tillage is weed control, and there is no reason for producing a dust mulch or for stirring the soil to a considerable depth. Faced with the necessity of conserving fuel and labor, this is quite important to the farmer.

Where available, tillage implements that operate just beneath the surface of the ground, leaving the weeds and other residues on the surface, should be used, as they help conserve both moisture and soil. It has been proved by experiment that a much higher percentage of the rainfall goes into the soil for crop use if a light covering of vegetative material is on the soil. Further, it has been proved that crop yields are materially increased by such methods, particularly if the rainfall happens to be somewhat deficient during the growing season. If the planting was made on the contour, still higher yields can be expected as more moisture is conserved by this practice.

¹ Chief, agronomy division, Soil Conservation Service, Washington, D. C.

While discussing weed control, I should like to point out that in areas where clovers and grasses are planted with grain, it is worth while to mow the stubble fields when there is considerable weed infestation. Such weeds as pigeon grass, ragweed, cocklebur, and smartweeds should be mowed in July, or whenever they overtop the stubble. They should be mowed high so as not to cut off the small clover and grass plants. In most cases, it will be necessary to mow again, probably in August, to prevent the weeds from seeding. This time the mower can be lowered to a height of 2 or 3 inches. Such operation will be of tremendous value in the clover and grass crop the following year. With limited supplies of fertilizer in sight, the importance of abundant supplies of legume and grass seeds cannot be overemphasized. They will be needed as cover crops to keep up yields of staple crops and also for pasture and forage production.

Peanut growers will be extremely interested in the results of experiments in Virginia, North Carolina, and Georgia in increasing yields of peanuts by dusting with sulphur to control leaf spot disease. Four years' results from sulphur dusting of peanuts at the Virginia Experiment Station show an increase of from 20 to 50 percent in the yield of nuts, and sometimes the yield of hay has been doubled. In 20 demonstrations in 1940 the cost for the dust was \$2.52 an acre, but the treatment increased the value of the crop by \$11.75 per acre.

At the North Carolina Experiment Station, copper-sulphur dusting produced increases averaging about 500 pounds of peanuts and 800 pounds of hay per acre. The cost of materials and labor was \$5 an acre, and the value of the increased yields of peanuts was \$15 per acre. More than 100 demonstrations with sulphur dust, carried out by the Extension Service in North Carolina from 1937 to 1940, showed an increased per acre yield of 261 pounds of nuts and 562 pounds of hay.

The Georgia Experiment Station reports similar results from sulphur dusting in seven Georgia Counties from 1937 to 1940, inclusive. The dusting increased the yield of peanuts 329 pounds per acre. Certainly these results justify serious consideration by peanut growers. State experiment station authorities and the Extension Service have full information and are in position to help materially in meeting the production goals for peanuts.

A new and more economical development in the control of noxious weeds is crop production combined with weed control. It has been learned, for example,

that bindweed on wheatland can be practically eradicated in 3 years, without interrupting wheat production. This system is as follows:

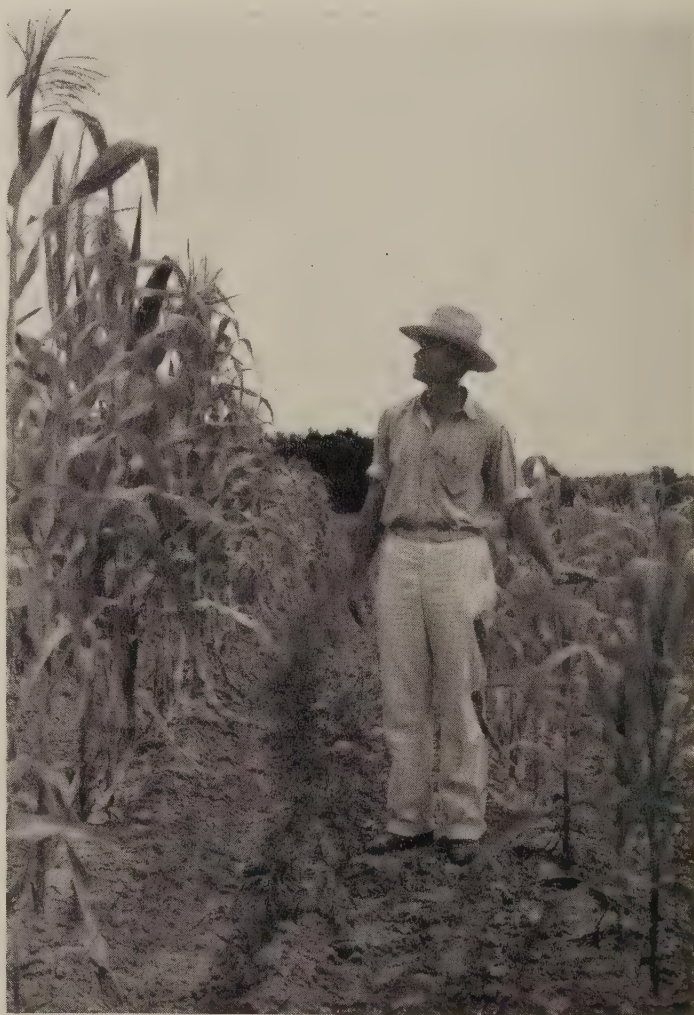
First year.—Fallow the land the first summer from May to September preferably with sub-surface tillage implements, each 2 weeks. Seed wheat at the normal time in the fall.

Second year.—After harvest, start subsurface tillage operations at once, continuing each 2 weeks until wheat-seeding time.

Third year.—After harvest, proceed as in the second year. It has been determined that the wheat will keep the bindweed under control, while the tillage operation reduces the infestation when the crop is not on the land.

Not much can be done to control diseases of forage and cereal crops during the growing season. It is important, however, that farmers contact their county agents or the State experiment stations immediately upon finding diseases in their fields, as it is possible

The value of a cover crop is well illustrated in this picture. The corn on the left is following lespedeza, that on the right is following cotton and corn. The yields were 28 and 7 bushels per acre respectively. Cover or green manure crops are of special importance during the present period when fertilizer is scarce.





On this sandy soil strips of sorghum or other tall-growing crops are essential to enable a farmer to produce peanuts. Wind erosion is a hazard without such protection. Contouring increases yields by conserving moisture.

that measures can be recommended either for immediate benefit or to prevent repetition the following year. In some sections of the country, disease-resistant strains of oats, barley, wheat, and sorghums have been developed and it is extremely important that the farmers make definite plans for saving seed of the resistant varieties and strains. While this has no material effect on production for this season, it is extremely important for next year.

As far as crop insects are concerned, general control measures for such insects as boll weevil, chinchbug, grasshoppers, and Hessian fly have been followed for years and are known by most farmers. The State experiment stations and the Bureau of Entomology and Plant Quarantine are continuing to improve and develop measures for the control of such insects as the Japanese beetle, Mormon cricket, and the European corn borer. Farmers should keep close watch for insects, and immediately ask the county agent or the State experiment station for information when it appears that infestations are beginning.

The Bureau of Entomology and Plant Quarantine has issued a summary of the insect situation as of the end of 1941. It appears the boll weevil was present in more than normal abundance throughout the summer of 1941 and, in view of the very mild winter, may present a stronger than usual attack this summer. The chinchbug was considerably reduced in numbers last year by the spring and summer rains during critical

development periods of this pest. The Japanese beetle hibernated with a low food reserve due to the dry weather, although there was a large increase in the total acreage of infestation. The dry weather of last summer in the areas infested by European corn borer may have a deleterious effect on this insect. Grasshopper surveys indicate that threatening-to-severe infestations may occur in local areas during the summer of 1942 in several of the midwestern States. There has been a general increase in the Hessian fly infestation throughout the major winter wheat belt. At present there are no indications of generally severe infestations for any of the principal crop insects, although of course we must understand that unforeseen weather conditions may change the picture within a relatively short time.

In studying and discussing insect pests, many of our entomologists have followed rather closely the developments in soil conservation practices. This is a natural and consistent trend, as any material change in cropping practices is bound to affect the insect situation. For example, there has been much discussion over the effect of strip cropping on the grasshopper situation—it was feared that the new field arrangement might make poisoning of the hoppers an impossible task. Such a situation has not as yet developed; instead it appears that it will be possible to develop control measures through the sequence and arrange-

(Continued on p. 300)

THE FLAG IS ON THE PLOW

By W. C. LOWDERMILK

ASSISTANT CHIEF, SOIL CONSERVATION SERVICE

*I*N the last reckoning all things are purchased with food. Such is the fateful and awful truth that hideous famines make known. World-wide war that today is strangling civilization further shows up the enormity of this fact. Food is necessary for victory. Food is rationed by aggressors to subjugate rebellious peoples of occupied countries. Peoples will sell their liberty, their all, for food when driven to extremes of this tragic choice. There is no substitute for food.

Seeing how much people will give up for food, let us look at the things food will buy; for money is only a symbol—a convenience in exchanges of goods we need and want. Our civilization is bought with food; our cultural advantages and satisfactions, our industrial achievements as a nation, and now our all-out war effort against treacherous and powerful enemies—all these are purchased with food.

Not until tillers of soil have grown surplus food beyond their own needs are their fellows released to take up other tasks than those of growing food—tasks of a complex division of labor that give rise to high standards of living and great national effort. This principle holds true regardless of the motive that may prompt tillers of soil to grow food beyond their own needs, whether urged on by whip-lashes of slave drivers, as in ancient Egypt, or by allurements of the profit motive in our heydays of peace, or by compulsions of war in our present crisis.

Lumberjacks do not log forest stands of timber unless food is made available. Miners do not dig the ore out of the bowels of majestic mountains—nor do skilled mechanics make powerful munitions of war. Brave soldiers do not fight our battles of freedom unless food is grown in abundance for their daily needs by our tillers of soil. Food, abundant and adequate, is necessary to victory. The flag is on the plow as well as on the battleship and on the tank.

Moreover, food comes from the land, our Mother Earth. The land, with its waters, affords us nourishment. Our war-time goal is maximum production from the land—our land, the silent partner of tillers of soil in this exacting and vital task. In this production the land must not be damaged and wasted in unwise and careless use—it must be safeguarded from all leanness. By saving the blessings of Heaven in the rain, holding plant foods within the soil, and conserving the soil itself we can keep and increase the productive powers of the land.

The land yields its increase to the husbandman who watches over and cares for it with understanding and skill. The earth rewards richly the knowing and diligent. This partnership of land and farmer is the rock foundation of our complex social structure and of our all-out war effort. It justifies our dream of a future after the devastating storm of war has passed, when we shall see in luminous clouds a rainbow over the sorrowing earth drenched with the blood of millions of men and women and children.

Withal, defense of the land and its productive power, as the source of our food, is the foundation of the defense of our country and our way of life against treacherous attacks of foreign aggressors who would work us woe. There is no substitute for food, for good land, or for the land we love.

WAR PRODUCTION AND THE TECHNICIAN

By WILLIAM T. ANGLE¹

EVERY soil conservation technician is right on the firing line. He can do his utmost for victory by tackling his regular work with his whole heart and soul.

Suppose, for instance, that a technician helps farmers lay out 1,000 acres of corn ground for contour cultivation, and that the yield is increased by 5 bushels an acre. That means the production of an additional 5,000 bushels of corn. Converted into terms of live pork, this represents a 44,000-pound increase in the live pork supply.

This example is conservative. The experiences of farmers and observations of agricultural workers indicate that yields were increased from 15 to 25 percent by contour cultivation on the sloping lands of the Northern Great Plains where row crops are grown and water runoff otherwise is appreciable.

Helping farmers put 1,000 acres of corn on the contour would take only part of a technician's time. He still could help put small grain on the contour, help establish grassed waterways, help get low-yielding croplands seeded to legumes and grasses—all measures that will boost the food supply. Worthwhile increases in close-growing crops, such as oats, barley, and wheat, have been obtained from contouring.

Or, the technician may be located in a part of the Northern Great Plains where rapid establishment of crested wheatgrass or other grasses on idle land is the big thing in upping food production. When he assists the farmers and rangers in the dry land areas of this northern region in establishing crested wheatgrass on 15,000 acres of idle land he is instrumental in making it possible for them to carry another 500 to 1,000 animal units. If 15 acres of crested wheatgrass, used appropriately on a seasonal basis, is equivalent to a year-long requirement for a cow, the increase amounts to 1,000 cows. If it takes 30 acres per cow, the increase is 500 cows. An 80-percent calf crop, then, means that the establishment of grass on 15,000 acres brings an increase of 400 to 800 calves for market.

But one may prefer to think in terms of sheep. The same land can furnish range for 2,000 to 4,000 additional ewes producing about the same number of lambs annually. In addition, the increase in wool

production totals 15,000 to 30,000 pounds a year.

This in itself certainly is no small contribution to the Nation's war effort—and it constitutes but one result of a technician's varied work.

How about those areas where inadequate water supply is the element that prevents full utilization of grass and other resources by farmers and ranchers? How much can the technician help increase food production by assisting in the development of springs, the construction of water-impounding dams and dugouts, the sinking of wells, the improvement of irrigation systems, the development of water-spreading facilities?

Take stock of all these things. They count up—you will find that you are in the war, and no doubt about it. Your part in increasing food production can exceed the individual output of any other single person in your community.

Ability to see clearly the job to be done is the big thing now—always of course, but especially now. The technician's job these days is to help farmers grow more of the foods most needed in the job of winning the war. Conservation practices are needed to get this done as well as to conserve resources. The farm planner, for example, can well afford to devote some time to helping district supervisors and county war boards as they concentrate on those conservation practices that will boost the output of needed foods in the shortest time possible. He should arrange priorities in the application of conservation practices in harmony with this aim. In normal times, 6, 8, 10, or more conservation measures may be necessary to bring about the conversions—in land use, farm developments and farm organization—for total application of conservation practices on a typical farm or ranch. But this is war-time production, and those conservation practices that will help the farmers to attain maximum output of food products must come first.

The farmers want it that way, and this is in full accord with Soil Conservation Service policy, a policy that works with the farmer to develop and apply conservation practices, in the order that is most desirable from all viewpoints.

Furthermore, every technician undoubtedly will have many opportunities to help war boards and district supervisors in their efforts to attain maximum

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(Continued on p. 303)

GROWING SOYBEANS WITH MINIMUM EROSION

By DWIGHT D. SMITH¹

RECENT research studies indicate that soybeans have a fair chance of losing at least a part of their reputation for being one of the worst crops for soil destruction through erosion. These research studies show that by providing a desirable soil condition preceding the beans, planting to secure maximum canopy protection to the soil, drilling for a fall and winter cover crop immediately following harvest, and reducing the slope hazard by use of supporting conservation practices, the soil losses will be reduced to a minimum amount well within the limits for conservation of soil resources.

Soil and water conservation studies as pertaining to soybeans have been carried out at both the Bethany and McCredie Soil Conservation Experiment Stations in Missouri. The Bethany studies were begun in 1931 on Shelby loam soil of 8 to 9 percent slope, and those on the McCredie station in 1939 on Putnam silt loam of about 3 percent slope.

Conditioning of the soil reduces losses.—The soil loss from the soybeans, winter barley, and meadow rotation at McCredie during 1941 was 2.5 tons per acre, as compared with 7.5 tons from the soybean and winter barley annual rotation, and 12.2 tons from the corn, soybeans, wheat and lespedeza, lespedeza rotation. Runoff from the three rotations in the order given was 16.4, 17.6, and 20.6 inches. Losses from the corn, oats, meadow rotation were about the same as from the annual rotation of soybeans and winter barley. Erosion and runoff during 1941 were high due to the excessive rainfall in April, July, and October. The soybeans were drilled solid, lengthwise of the plots. All crops of the rotations were grown on individual plots.

In planning the McCredie rotation studies, soybeans were recognized as a crop of economic importance for the claypan soils. The rotations were designed after a study of the soil and water losses from the Bethany rotations (1) by monthly periods, as shown in the chart. These studies indicated the critical periods for soybeans, their unfavorable position when following corn, and that losses from soybeans could be appreciably reduced by combining them with excellent erosion-resisting crops.

In the soybean, winter barley, meadow rotation, a maximum of vegetative protection is provided. Immediately after the soybean harvest in late August, winter barley is seeded. This early seeded crop develops in time to give protection to the soil from the late fall and winter rains. Meadow seeded in the barley provides protection after the barley is harvested, throughout the next year, and into the spring of the second year following seeding, until plowing for soybeans. The conditioning of the soil, by the organic matter additions and the soil binding qualities of the meadow roots, carries over into the soybean cropping period to reduce runoff and soil loss from the soybeans, just as does the sod that precedes a corn crop. (2)

The accompanying table shows the soil and water losses by periods for the soybean years of the three McCredie rotations. The total calendar-year soil loss for soybeans following meadow was 5.3 tons per acre, as compared to 7.5 tons when following winter barley, and 23.9 tons when following corn. For a 4.61-inch rain the middle of April, the soil loss from the meadow preceding the soybeans was less than 1 ton per acre, while that from the cornstalk plot was 13.3 tons. During the rains of July, a similar relationship existed, although not so extreme. In the fall, soil losses from the three plots were relatively low considering the amount of rainfall. The two plots in winter barley, however, had appreciably less run-off than the one with the soybean stubble.

Maximum canopy protection reduces losses.—At the Bethany station, both the soil and water losses for the period, April 1 to September 30, from soybeans drilled solid and grown in a corn, soybean, wheat, meadow rotation, have averaged 37 percent less than when the beans were planted in 42-inch cultivated rows and grown in a corn, soybean, oats, meadow rotation. The soil loss for the 6 months' period, October 1 to March 31, from the plot of the latter rotation, which was without a cover crop until after drilling of oats the next spring, averaged 4.5 times greater than that from the other rotation plot which was drilled to wheat the last week in September.

An example of the canopy protection provided by soybeans, drilled solid when at their maximum growth stage, was provided by the 50-year frequency rain of August 13, 1940, at the McCredie station. The

¹ Project supervisor, Missouri Agricultural Experiment Station and Soil Conservation Experiment Stations, Bethany and McCredie, Mo. cooperating.

Table showing soil and water losses, by periods, from the soybean crops of the McCredie station rotations, 1941

Rotation	Cover *	Period *	Rainfall	Runoff	Soil loss per acre
			Inches	Percent	Tons
Four-year: Corn-soybeans-wheat and lespedeza-lespedeza.	Corn stubble.....	Jan. 1 to May 20.....	11.8	33	13.4
	Soybeans.....	May 21 to Aug. 24.....	12.8	36	8.6
	Soybean stubble.....	Aug. 25 to Oct. 6.....	18.2	51	1.4
	do.....	Oct. 7 to Dec. 31.....	11.4	47	.4
Total.....			54.2	42	23.8
Annual: Soybeans-winter barley.....	Barley.....	Jan. 1 to May 20.....	11.8	19	3.6
	Soybeans.....	May 21 to Aug. 24.....	12.8	33	1.8
	Barley.....	Aug. 25 to Oct. 6.....	18.2	36	1.5
	do.....	Oct. 7 to Dec. 31.....	11.4	41	.6
Total.....			54.2	33	7.5
Three-year: Soybeans-winter barley-meadow.....	Meadow stubble.....	Jan. 1 to May 20.....	11.8	31	.9
	Soybeans.....	May 21 to Aug. 24.....	12.8	29	3.4
	Barley.....	Aug. 25 to Oct. 6.....	18.2	33	.9
	do.....	Oct. 7 to Dec. 31.....	11.4	31	.1
Total.....			54.2	31	5.3

* Soybeans drilled on May 20, harvested Aug. 21, and barley drilled Aug. 25; Oct. 6 was the date wheat should have been seeded in the 4-year rotation, but rain-saturated soil prevented drilling on this or a later date in 1941. Barley on the annual rotation plots was grazed by cattle Apr. 23 to May 20 and Sept. 24 to Oct. 22.

soybeans were over knee-high at the time of the rain and provided a complete canopy cover for the soil. During 30 minutes of the storm, 2.25 inches of rain fell. Runoff from the plots was less than from any of the other plots, and practically free of silt.

Losses are not excessive on terraced land.—Data are available from the rotation of corn, soybeans, wheat, meadow on terraced Shelby loam soil of about 9-percent slope at the Bethany station, for the 10-year period 1932 to 1941. Each crop of the rotation was grown each year on an individual inter-terrace area. The soybeans were drilled solid and all operations were on the contour.

Soil loss from the rotation, as measured at the ends of the terraces, averaged only 2.12 tons per acre per year, or a rate equivalent to removal of the surface 7 inches in about 500 years. This rate of loss was less than from other station studies upon which the fertility level was being maintained. (3) (4) The soil loss from the rotation, however, was the greatest for any rotation on terraced land, and there was appreciable movement of soil to the terrace channel. As these terraces have required very little maintenance during the last 8 years, it is thought that this movement of soil to the channel is largely accounted for by the method of up-hill plowing which is followed. (1)

Soil and water losses by months are shown in the accompanying chart for the 48 months of the 4-year rotation on the terraced land. Corn and meadow (clover-timothy) both occupied the land for 17-month periods during the rotation cycle. Soybeans occupied the land 6 months, and wheat the remaining 8 months.

The soil loss occurring during the period for corn was 44 percent of the total rotation soil loss, whereas that from soybeans was 34 percent, from wheat 9 percent, and from meadow 13 percent.

The weaknesses of the rotation from an erosion control standpoint are that corn is not followed in the fall by a cover crop, the soybeans follow the corn, and wheat following the soybeans is not seeded sufficiently early in the fall to provide protection to the soil from late fall and winter rains. Elimination of corn from the rotation and seeding of rye immediately following soybean harvest, in place of the later seeding of wheat, would have reduced the rotation soil loss to less than one-half ton per acre per year, on the basis of the 1941 McCredie results.

Projection of Data

Soybeans may be grown in a rotation with fall-seeded small grain and meadow crops, with materially less erosion than from the same type rotation but with corn instead of soybeans, if the soybeans are drilled, and about equal losses if the soybeans are in 42-inch rows.

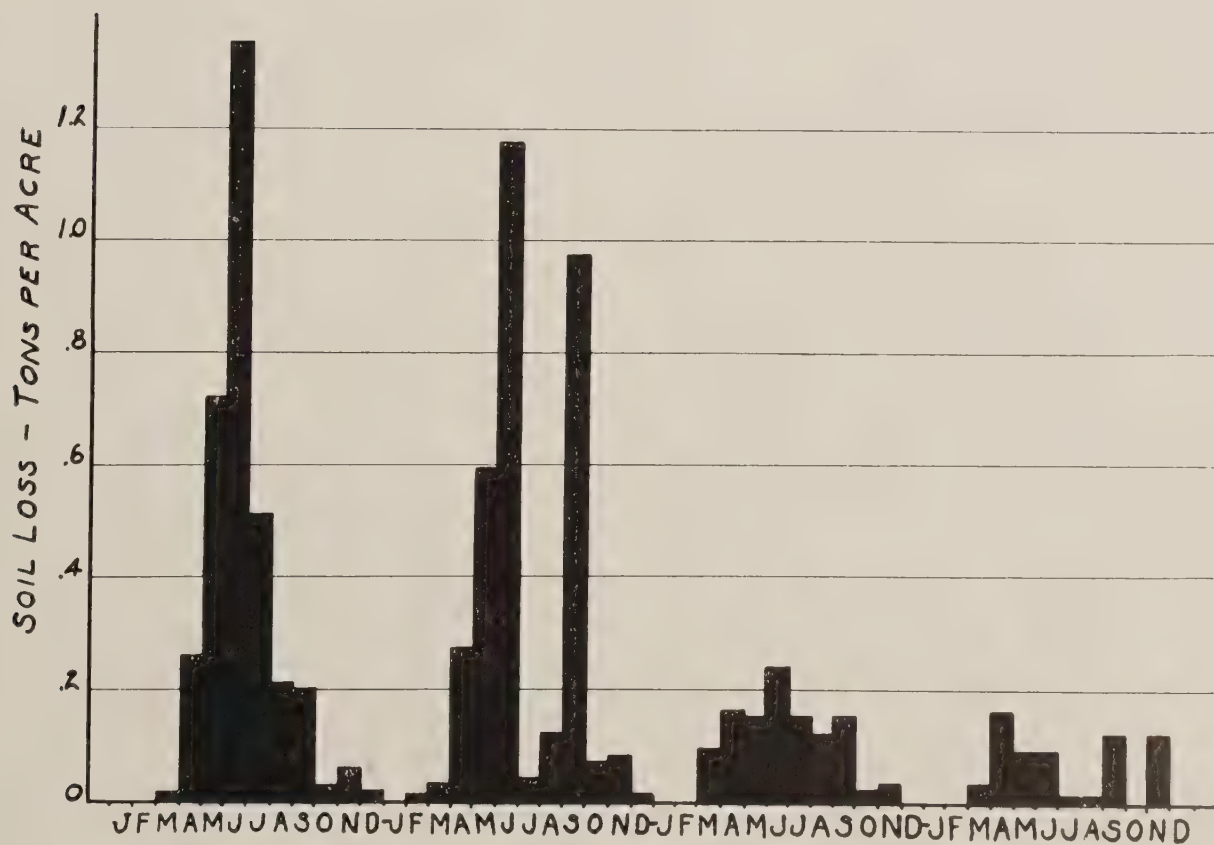
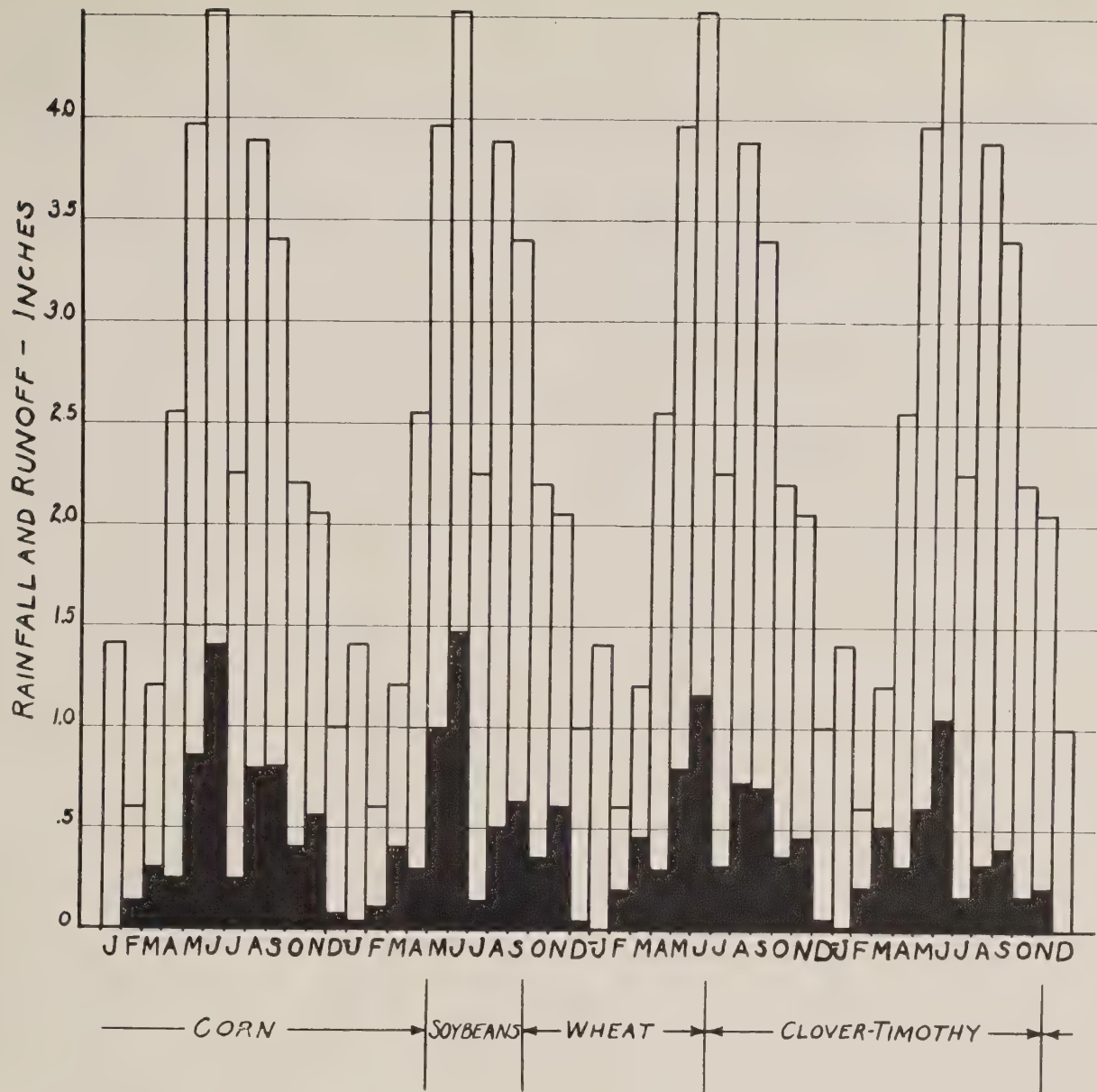
The erosion hazard from soybeans drilled solid in an annual rotation with winter barley appears to be no greater than with the rotation of corn, oats, meadow.

The rotation of corn, soybeans, wheat, meadow has several critical erosion periods, which preclude its use without supporting practices on sloping land subject to erosion. Even with the support of terraces

(Continued on p. 300)

THE CHART—Page 297

Ten-year average rainfall, runoff, and soil loss from a rotation of corn, soybeans, wheat, clover, timothy on terraced land. Soil Conservation Experiment Station, Bethany, Mo.



WIND EROSION IN THE PAMPAS OF ARGENTINA

By MANFREDO A. L. REICHART



The result of wind erosion—formation of dunes and moving sands which cover an area of 300 hectares to the west of Mackenna, Province of Córdoba.

THE Republic of Argentina has not been spared suffering in its own flesh the disastrous effects of soil erosion caused by wind and by water.

We have not profited by the grievously costly examples long displayed to us by countries like Canada, the United States, South Africa, Australia, etc. Through erosion these countries have ruined extensive areas of fertile fields, whose productivity can be restored only at great expense of money, sacrifice, and time.

In our country we have typical examples of water erosion in the subtropical region of the northeast, particularly in Misiones. There are also some examples, but of minor importance, in the central eastern part of the country (the Littoral), in southern Entre Ríos, in Santa Fé, in Córdoba, and south of Buenos Aires.

But the effects of water erosion are slight in comparison with the destruction that wind erosion has inflicted upon the agricultural land of Argentina.

The zone most seriously affected by aeolian erosion lies in the west-central part of the country, especially in the area lying between 30° and 40° south latitude and between 61° and 66° west longitude.

The phenomenon has been of major importance in the southern parts of the Provinces of Córdoba, San Luis, and Buenos Aires, and particularly in the Territory of La Pampa—becoming especially severe in the east-central, west-central, and southwestern parts of the area mentioned.

EDITOR'S NOTE.—SOIL CONSERVATION acknowledges with appreciation the services of Miss Lois Olson in supplying the English translation of this article. The author is Chief, Soil Section, School of Agriculture and Veterinary Science, University of Buenos Aires.

This semiarid zone in the center of the country is characterized by a moderately warm climate, with temperatures high in summer and low in winter, and with scant rainfall that varies from 400 to 600 mm. per year and is distributed over 50 to 80 days.

According to Arena,¹ "it is a contact zone between two huge and rapidly moving air masses of different temperatures and densities; that from the north being hot and humid and the other from the southwest being dry and cold," the latter being the chief agent of wind erosion.

From an ecological standpoint, a portion of the region partakes of the characteristics of the savanna-grassland association but much the larger part consists of steppe vegetation characteristic of the plains, which comprise much of the pampa region.

The soil of the region is to a large extent loess, aptly termed "pampa loess." It consists of very fine particles, of a color varying from yellowish to greyish chestnut, reddish below and in places also grey verging upon green. It is of volcanic origin and has been transported by wind and water from the high mountain ranges of the west.

A noteworthy feature of the pampa soil, locally called "tosca," is the binding together by lime introduced by the infiltration of surface and subterranean waters. In part this appears in the form of nodules, rounded or branched, but also in solid compact layers of considerable thickness. In the highest part of the plain in southwestern La Pampa there is a true terrace of compact "tosca" that extends from the mountain ridges of Buenos Aires to the Territory of La Pampa. Above this loesslike, sandy formation, there is a thin capping of true soil that merges gradually into the parent material.

Obviously this must be considered a region of very sandy, porous soils, exceptionally poor in adhesive clay-humus colloids and, because of this, structurally deficient and unstable, and easily dispersed.

For these reasons, the soils of the region as a whole have a low capacity for retaining moisture and are extremely susceptible to blowing. The arboreal vegetation consists of clumps of associated species of islets, interspersed throughout the plains, with their

¹ Arena, Antonio. *La Conservación de la Fertilidad del Suelo*. 50 pp., illus. Buenos Aires, 1940. (Reprinted from *Conferencias* 5: 183-199, 1940.)

coarse vegetation. The islets consist of calden (*Prosopis caldenia*) associated with black algarroba (*Prosopis nigra*), chañar (*Gourlaea decorticans*), molle (*Schinus polygamus*), alpataco (*Prosopis alpataco*), jarilla (*Larrea divaricata*), etc.

By contrast, Gramineae predominate in the herbaceous steppe vegetation of the plain, which is known as the erosion zone. Among the herbaceous plants are the coarse herbage, or "pastos duros," consisting of various species of *Stipa* of xerophytic character, and other sand-loving species.

Up to the present, the protective action of this mantle of vegetation has prevented the devastation of the soil on a large scale by the action of the wind. But natural factors, in conjunction with human, have destroyed this natural equilibrium and the fertile soil over a large area, noted until recently for its great productivity, has been blown away.

Few words suffice to explain the causes that precipitated wind erosion in a region of such great productivity.

In relatively recent years, various parts of the zone have been brought into cultivation, thereby increasing considerably the profits of agriculture. For the sake of agriculture, trees have been cleared over extensive areas and, in other places, the steppe cover has been destroyed by the plow.

Deprived of the vegetation that held it together, giving cohesion to the entire mobile mass, the sandy soil became particularly susceptible to blowing as soon as it dried out. The prolonged drought of the last 10 years, 1930-40, accompanied by strong winds from the southwest that swept over the great plain without orographical features, have been the immediate causes of soil erosion.

During the past year, the city of Bahía Blanca has suffered a torment of blowing soil, so intense that it has obscured the full light of day.

The lowering of the water table, caused by the reduction of the reserves of soil moisture by crops



Sandy cultivated soil covered with loose sand, encroached upon by "morena," a plant invader.

and herds, combined with other man-made technological factors such as inadequate cultivation, overgrazing of pastures, an exaggerated single-crop system, techniques not adapted to cultivation during drought, and the afore-mentioned destruction of trees and natural grasslands, continued to increase the intensity of normal wind erosion.

To this is added, as Arena aptly comments, "The regime of colonization based on a mistaken system of land tenure in which large proprietors or stock companies are obligated to produce wheat, the development of animal husbandry is prohibited or prohibitively limited, no compensation is made for soil conservation installations and individual technical advice on proper methods of cultivating the soil is lacking." He later adds, "The advance of erosion in La Pampa is the advance of desert accompanied by economic confusion and increasing social maladjustment. By the irony of fate, first the desert was conquered, then disheartened farmers, in turn, deserted it, themselves conquered in the unequal struggle with the tremendous impulse of natural forces."

As early as 1931-33, through the initiative of German-Argentine Agrarian Union S. A. and before the repeated crop failures due to prolonged droughts, a large contingent of farmers, more than 2,000 families, moved from La Pampa to El Chaco, establishing themselves in the colonies of Florida and Castelli.

It is clear that an old problem is now under discussion, but one which has assumed alarming proportions, especially in the year 1939-40, and one that threatens to develop over enormous areas in the Provinces of Buenos Aires, Córdoba, and San Luis and the Territories of La Pampa and Rio Negro. The executive branch of the national government has intervened to the extent of preparing and submitting a soil conservation bill.

On the other hand the National Ministry of Agriculture, through the Division of Soils, has undertaken an investigation of wind erosion in central-western Argentina, having already published a first preliminary reconnaissance survey on the effect of wind on the soils of the Territory of La Pampa and the adjacent



Chañar coppices, which form small windbreaks, in the area between Rio IV and Cañada Verde, Southern Córdoba.

areas. In it the causes of erosion and the methods for its control are clearly set forth.

Without doubt little or nothing has been done, up to the present, in the practical application of the recommended control measures. A single humid year sufficed to erase totally from the mind of our farmers the horrible pictures that they had seen lived a

short time before. Already no mention is made of further erosion. The farmer has returned again to the agricultural practices of earlier times without worrying greatly that erosion is but concealed and lying dormant like a lion in ambush, standing expectantly in wait for its prey, hoping only for the wind to change in order to make a new attack.



A fall-seeded grain or other cover crop following soybeans harvested for grain is an essential practice if yields are to be maintained and the soil conserved. In this instance, winter wheat has been planted after the soybeans were harvested.

CROP HUSBANDRY IN THIS YEAR OF WAR

(Continued from p. 291)

ment of crops in the strips, as pointed out in an article by Messrs. Wilbur, Fritz, and Painter, in the January 1942 issue of the Journal of the American Society of Agronomy.

Here is another interesting point in connection with strip cropping and the control of insects: A study conducted by biologists, in southwestern Ohio, to determine the effect of strip cropping on nesting birds shows that the number of nesting birds per 100 acres of meadow strips was double the number in regular meadows. It may be that the birds are anticipating an increase in insect food due to the new field arrangement—if so, then certainly the greater number of birds will be very helpful in controlling the insects!

It is probably as well to point out, in conclusion, that there are no new good husbandry methods that can be pulled out of the hat to meet the increased crop acreage problems. Timely efforts, looking toward the control of the enemies of crops and the conservation of moisture and plant food, are extremely important,

and the farmer who obtains excellent yields will be the one who is on his toes, ready to thwart any blitzkrieg from insects, weeds, or diseases, the farmer who works hard to conserve the rainfall and all of his soil for crop production.

GROWING SOYBEANS WITH MINIMUM EROSION

(Continued from p. 296)

on fertile land of moderate slope, the erosion loss approached the maximum allowable.

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NEIGHBORHOOD ACTION

By IVAN McKEEVER¹

A CONSERVATION plan on every farm just as soon as possible—that was the goal set by the supervisors of the Tygarts Valley Soil Conservation District, Barbour and Upshur Counties, W. Va. Their problem was to explain the district program to the 3,500 farmers within the district area and enlist their active cooperation. The supervisors realized that their objective would require careful planning and positive action.

Only a few Soil Conservation Service men could be assigned to the district at the time—far too few to reach the farmers quickly by the old project or individual approach method. To use these men in the most effective manner, to obtain the greatest results, the supervisors decided, first, to secure the loyal support and active cooperation of all the agricultural agencies working in the district, and, second, to organize the farmers into groups for neighborhood action. The supervisors knew that success of the first phase of their problem would go a long way toward achieving their main objective, and with this in mind they invited the representatives of all the agencies in the two counties to a meeting, to discuss a plan for neighborhood organization. The response was inspiring—the county agents, Farm Security Administration county supervisors, Agricultural Conservation Program representatives, and Vocational Agriculture teachers spent approximately 2 days with the supervisors helping to divide the district into 97 neighborhoods and select an organization leader for each, with the idea that this leadership might change as the neighborhood program developed. The plan is to use the neighborhood leaders as assistant district supervisors, to represent the district in their respective neighborhoods and their neighborhoods in the over-all district program. They will attend special meetings to obtain suggestions and to keep in touch with the program. The idea is that the entire program will work through the neighborhoods, with the local leader taking the initiative in organizing for education, group planning, and application and follow-up of conservation methods, to the end that the entire neighborhood will become active in a program for 100-percent conservation of the land resources.

Following this meeting, the supervisors wrote a

letter of appointment to the 97 neighborhood leaders, inviting each of them, in this same letter of appointment, to an all-day meeting at the county seat, to meet with the supervisors and others for a general discussion of the over-all district program. This meeting was also intended to give the neighborhood leaders an opportunity to get acquainted with each other, and with supervisors and agricultural workers. The turnout to this neighborhood leaders' meeting was approximately 50 percent. Many who were unable to be present sent their regrets, either in writing or by speaking to some member of the Board of Supervisors.

The morning session of this neighborhood leaders' meeting was given over to general discussion, with many of the leaders taking an active part, and to brief talks by representatives of each of the agricultural agencies. The afternoon session consisted of a field trip to a nearby demonstration farm, to give the leaders an opportunity to go over a farm with a complete conservation program already in operation. Naturally, the field trip aroused more interest and enthusiasm, and brought out more queries, than the morning discussion. Before the meeting broke up, each leader was given an envelope containing the supplies he would need in stimulating interest in his particular neighborhood—bulletins on neighborhood organization and pasture management, cards of application for farmers who wished to cooperate with the district program, folders explaining what the Tygarts Valley district program was about, and copies of the cooperative agreement being used in the district.

At a later meeting of the Board of Supervisors, it was decided to divide the neighborhood leaders fairly equally among the supervisors. In other words, each supervisor would be responsible for aiding approximately 20 neighborhood leaders in getting better acquainted with the program and starting the work in the various communities. It was decided also that each supervisor would see that leaders who were absent from the general meeting would receive an envelope of supplies, and that each supervisor would visit, as soon as possible, all of his neighborhood leaders and discuss with them the best method for getting the program started.

It was hoped that from such contact between the supervisor and neighborhood leader a program would be developed that would call for a "get together" of all the farmers of the neighborhood—at a school house or church, at a farm home, or perhaps a day-

¹ Regional agronomy division, Northeastern Region, Soil Conservation Service Upper Darby, Pa.

time meeting on some farm for the purpose of discussing and working out a conservation plan. The kind of meeting was to be left to the best judgment of the neighborhood leader, in counsel of course with his supervisor.

It was agreed that meetings of this type would be assisted by someone capable of helping the farmers in organizing their neighborhood. All the supervisors were of the opinion, however, that wherever possible this help in organization should come from, first, the neighborhood leader and, second, his sponsoring supervisor. Should the assistance of an agricultural agency be required, then the request would be made directly to the office of the county agent, who would arrange for a representative capable of aiding under the particular circumstances. In the event of a night meeting involving a large number of people, where the objective was to create desire on the part of farmers to cooperate in the soil conservation district program, the county agent might go himself, send someone from his office, or call upon a representative of a Federal or State agency, including the Soil Conservation Service, to help with this type of meeting.

After sufficient interest has been aroused, the neighborhood leader will call a second meeting. This second meeting will be for those farmers who have indicated that they want assistance in formulating a soil and water conservation plan for their farms, and it will be attended by a farm planner from the Soil Conservation Service. The farm planner will have a land-use capability map for each farm represented, and will discuss with the farmers the meaning of the maps, their value, and how to use them in planning their program.

The land-use capability maps are introduced in this manner as a means of getting more widespread coverage and understanding on the part of the farmers and cooperators in the district. It was recognized at this meeting that land capability maps would be of great value in a program based on group action.

The ultimate success of this type of soil conservation program will depend upon a number of factors. The first 3 months' accomplishments in this West Virginia area seem to indicate that the whole-hearted cooperation of all agricultural agencies in backing a neighborhood organized district is going to give excellent results.

The first quarter of a year showed 103 cooperating farms, covering approximately 14,000 acres. All the plans were worked out with the farmer and were as complete as the farmer and farm planner knew how to make them, after they had carefully considered both

economic and physical factors. The farmers accepted the entire program, along with the responsibility of doing the work, after they understood that they would have ample time to complete the job, even though they were encouraged to get some work done as soon as possible.

All strip boundaries on the cooperating farms are on the contour and are plowed in as soon as possible after the agreement is signed on all fields needing strip cropping. The first 103 farms already have over 1,700 acres of contour strip cropping boundaries plowed in. By following this method of lay-out, a relatively small amount of technician time is needed, the job is well done, and the farmers have the satisfaction of being a part of the program during its beginning stages. The supervisors feel that the more time-consuming and technical jobs will come easier if the farmers are brought into the program by doing the things they can do without delay.

Cooperation of Federal and local agencies, as well as of farmers, is being stressed in this new soil conservation district in West Virginia. The Soil Conservation Service, of course, has been "in the middle" of the program from the beginning. Farm Security Administration workers are insisting that all of their clients have a conservation program with the district. The county agents of the Extension Service are pushing the work in groups and with individuals, and the Vocational Agriculture instructors of the district are organizing their day classes and evening schools so that the teaching of soil and water conservation will receive major consideration. Vocational Agriculture departments already have come to the supervisors and asked to sponsor work, such as laying out strip cropping, building diversion ditches and planting trees, on certain farms. The work is to be done free of charge for its value in teaching the boys the best practices of soil and water conservation. It is also planned that these boys will be able to aid on their home farms in laying out and installing conservation measures. The same procedure was applied for the larger 4-H boys' groups in both of the counties of the Tygarts Valley district. At the 4-H county camps last summer, a class of instruction in soil conservation work was included for the older boys, taught by a member of the personnel of the Soil Conservation Service located in the district.

The supervisors realize that they have just started, but they feel that they have made a good beginning in organizing their district into neighborhoods for effective action toward conservation of the farm lands of the whole of this large area.

OSAGE-ORANGE PLANTINGS

By CHARLES F. McGRAW and JOE B. DAVIDSON¹

THE Osage-orange, first widely used for hedge fences in the Corn Belt about 1850, began to disappear about 1910 when miles of hedges were uprooted. At about the same time a marked decrease of quail and other kinds of wildlife was noted, for the Osage-orange not only provides shelter where trees are scarce but furnishes food for the fox squirrel, gray squirrel, muskrat, rabbit, black-tailed deer, crow, pheasant, crossbill, and other small birds.

Of the many species of plants used for woodland and wildlife plantings, Osage-orange has been found by soil conservation technicians to be one of the most valuable. There are four ways in which it may be used on the farm:

1. As a hedge and living barrier of one to three rows around reforested areas to develop a dense, thorny border impenetrable to livestock.
2. In pastures as a border planting around wooded areas to protect them against wind and grazing.

¹The authors are junior biologist at Edgington, Ill., and associate biologist Kewanee, Ill. Upper Mississippi Region, Soil Conservation Service.

BIRDS AND CONSERVATION

SONGBIRD populations have increased 20 to 40 percent on farms in Delaware, Maryland, and New York where soil conservation measures have been practiced for 3 years. In New York, breeding birds are now twice as numerous in strip-cropped fields as in comparable fields not in strips; species as well as numbers of individual birds have increased. A recently constructed flood storage and stock pond, fenced against grazing cattle, already has demonstrated the value of protected water areas in attracting songbirds, marsh birds, and waterfowl. Since the completion of the pond, eight additional species of birds have been observed to use it and the surrounding area.

On the farms studied in the Northeast, hedgerows have the highest bird populations of any habitat. Censuses of brushy fence rows in Delaware and New York revealed populations of 30 to 50 pairs of nesting birds per acre, which is equivalent to approximately 1 pair in each 100 feet of hedgerow. These data indicate the importance to wildlife of the managed contour hedges that have become a supplementary soil defense measure on many farms in the Northeast.

3. As a plantation for supplying farm wood products. In a few years straight posts may be produced and an excellent return thus realized. The plantation may be located where it will offer protection for feed lots.

4. As an odd-corner planting to provide small wildlife escape coverts of 25 to 50 trees. These plantings will also grow a post crop, and help to control erosion.

The whole tree may well be utilized on most farms. Of course, the post is the most important part, but the tops and branches may also be used. The larger branches make excellent fuel wood, the smaller may be used as brush barriers in pasture to protect small gullies and galled spots from livestock. Usually these spots are "healed over" by the time the brush has decayed. These brush barriers also are valuable for cover and travel lanes for wildlife. Rapid growth of sprouts from new stumps quickly reproduces a stand and provides rapid return of good cover after the posts have been cut.

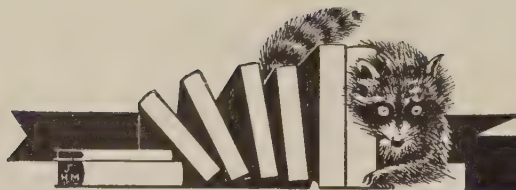
A 3-year study in New York showed that in a 6-acre tract of mature mixed hardwoods, protected from grazing for about 40 years and supporting a dense undergrowth, there were about 5 pairs of breeding birds per acre. Thus it is apparent that small tracts of protected woodland may rank second only to hedge rows as breeding habitats for songbirds.—J. K. Terres and E. C. Murdoch.

WAR PRODUCTION AND THE TECHNICIAN

(Continued from p. 294)

food production on farms which have not yet been planned for conservation.

Appropriate conservation measures and attainment of war-time food goals go hand in hand. Consider the priority of conservation measures in their relation to food production. Evaluate the conservation practices in talks with district supervisors and the war board. The opportunity is at your door—to help plan and carry to a successful conclusion on all-out food-for-victory program. Put first things first, and your aid in establishing appropriate practices for developing, utilizing and conserving water and soil resources will make more certain the attainment of the food goals.



BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neill Faris

PASTURE RESEARCH IN SOUTH AFRICA. By the Division of Soil and Veld Conservation, Department of Agriculture and Forestry of the Union of South Africa. Pretoria, 1940.

Something is going on in South Africa that we must not overlook war or no war. The soil conservation people down at the bottom of the great Dark Continent are doing truly remarkable things with grasses, a few shrubby plants, and a strong feeling of national service and responsibility. It is not often that one finds a "report" of this scope and quality—compiled by a keenly alive group of research workers and addressed to their Chief, the Secretary for Agriculture and Forestry of a country such as the Union of South Africa. The expressed purpose of the 390-page report is twofold: First, to point out, with authority, the dangers to South Africa of "famine and national calamity" by way of "intensified drought effects, veld deterioration and attendant heavy losses of livestock, falling crop yields, soil erosion, and the impoverishment of farmers and country life generally"; and second, to give the results, good or bad, of a coordinated research program planned less than a decade ago and carried out steadily and purposefully by survey, experimentation at eight special stations in different regions, and by practical application on the lands of private cooperating farmers.

The introductory section of the book is rather a remarkable document in itself—remarkable especially for an intrepidity of statement concerning the futility of Government loans and subsidies to farmers while exploitation of soil is allowed to continue unabated. Some interesting points are brought out, too, about the status of South Africa as an exporting nation and the effect of this upon the land itself. One sentence is particularly pointed and fearless: "* * * it would be refreshing to see the ingenuity of the economist directed toward the framing of laws, tariffs, and subsidies for soil preservation." Apparently, in their determination to carry through an extensive set of studies for the preservation of the soils of their homeland, these scientists and practical farmers have encountered many a problem outside the boundaries of their laboratories, plots, and experimental fields, similar and sometimes almost identical to our own.

This book is especially interesting to those of us who read W. R. Thompson's "Moisture and Farming in South Africa," a 1936 book reviewed in the October 1937 issue of *SOIL CONSERVATION*. In those days the big argument in South Africa was aridity and what caused it and whether or not its increase was due to natural causes—Were farmers going to have to give up farming and take to the life of the shrouded Saharan on horseback? Now it develops that even then, and all along the way since then, the plant men of the Union, led by Dr. I. B. Pole Evans, Plant Industry Chief, were industriously pushing ahead with their grassland and veld experiments with the firm conviction that, aridity or no aridity, the urgent need was for plant cover, bountiful and protective, over the ill-used soils of their land, to hold the moisture, to feed the livestock and to be turned back to the land for continuous building up and maintenance of fertility.

The tremendous scope of the pasture research that has been

carried on throughout the Union during the past decade certainly should be emphasized for the benefit of other countries including the United States of America. Beginning in 1934, special stations were established—eight in number—in areas representing different physical problems so that the valuable findings of the grass breeding and seed production experiments of the two older Pretoria stations could be extended quickly and in an over-all program. Surveys were then made, and experimentation started, in the sourveld, the Transvaal bushveld, the middleveld of the Transvaal and northern Orange Free State, and the tall grass veld and the mountain sourveld of Natal. The work then went forward rapidly to determine the best grasses, shrub vegetation, and legumes for reclamation of the many veld variations, and keys to grazing management plans to fit requirements of the land and the livestock industry.

Pasture specialists in almost all parts of the United States will be interested in the results of the South African experiments because, although we usually think of the southernmost country of Africa as arid and semiarid, there are, as revealed by this report, many relatively large zones with local climatic conditions tending to the humid. As for our Great Plains, and our arid Southwest, many of the South African findings will be directly applicable—and no doubt gratefully received by soil conservation and pasture management workers in those regions.

A nine-page list of the pasture plants that have been tested at the Prinshof Grass Breeding Station is given early in the book, with brief reference to results. This list contains many species native to the Union, many from Australia, the U. S. S. R., England, and the United States. Relatively few of the imported plants were proved of value for South Africa's veld and pasture needs, so that to a large extent the problem evolved into one of improving indigenous species, establishing permanent year-round pastures, and planning maintenance management to build up and keep in condition those grazing lands already in existence. Seed production as an important part of the over-all plan has received considerable attention at Prinshof, and the ecological studies of grasses indigenous to South Africa point to a narrowing down of the whole tremendous scheme to save the soils and the livestock industries of the Union.

Very detailed reports are given, by chapters, of the work at the special stations; each is a volume in itself. The areas are carefully described as to soils, plant communities, cultivable land, farming and grazing methods, and weather and rainfall conditions. The experiments conducted depend of course upon the area in which the station is located, but all of them have to do with pasture and veld problems such as sward composition and palatability, live-weight changes in stock, controlled grazing for veld maintenance, herbage yield, seasonal variations in pasture values, bush density and composition, reclamation of scrub pasture and thornveld, botanical analyses to determine edible plants for nursery production, and grazing management by fencing on private farms.

In the highveld area, winter forage seems to be the paramount need, and because of this the experiments with grasses for hay and silage are stressed; while in another area, at the Estcourt station, pastures under irrigation are being tried out to determine the value of this method for milk production on a large scale.

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Compiled by ETTA G. ROGERS, Publications Unit



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ON THE ALERT

READY FOR ENEMY PLANES
OR FIFTH COLUMN INSECTS

See page 289

